CASTRATION

(CRYPTORCHIDS AND CAPONING)

AND

OVARIOTOMY

HOBDAY

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(INCLUDING CRYPTORCHIDS AND CAPONING)

AND

OVARIOTOMY

BY

FREDERICK T. G. HOBDAY, F.R.C.V.S., F.R.S.E.

HONORARY VETERINARY SURGEON TO HIS MAJESTY THE KING; EXAMINER IN SURGERY AND OBSTETRICS TO THE ROYAL COLLEGE OF VETERINARY SURGEONS; FELLOW OF THE ROYAL SOCIETY OF MEDICINE; HONORARY MEMBER OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION; MEMBRE CORRESPONDANT DE LA SOCIÉTÉ DE MÉDECINE VÉTÉRINAIRE DU BRABANT; AND FORMERLY PROFESSOR IN THE ROYAL VETERINARY COLLEGE, LONDON.

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TO

PROFESSOR CADIOT

THE DISTINGUISHED PROFESSOR OF SURGERY IN THE
ALFORT (PARIS) VETERINARY SCHOOL
THE SECOND EDITION OF THIS LITTLE WORK IS DEDICATED
AS A TOKEN OF THE
AUTHOR'S ESTEEM AND FRIENDSHIP

PREFACE TO THE FIRST EDITION.

UNTIL recent years operations involving the interior of the abdomen have been considered to be accompanied by the gravest risks, and the percentage of fatalities used, indeed, to justify this assumption. Nowadays, however, thanks to the researches of Pasteur and their adaptation by Lister to modern surgery, the introduction of antiseptic methods have altered all that, and the surgery of the abdomen has taken its proper place with that of any other part of the body.

It is not to be inferred that an abdominal operation should be lightly undertaken, as, of course, it will always figure as a major one, but the results of present-day work show that, with careful manipulation and strict attention to true surgical cleanliness, the proportions of successful sequelæ are quite as great as with any other operation of importance.

Cryptorchid operating is to a certain extent very much like the "lucky bag" competition of a bazaar. Even the most experienced surgeon cannot always tell, before making an exploratory examination, what is in front of him, the exact site in which he will find the testicle (he may not be able to find one at all), or the abnormal condition of that organ when found.

Ovariotomy of the mare is much more straightforward, for the reason that variations in character and position are much

less common than those which occur in the testicle of the cryptorchid horse.

Neither offer insuperable difficulties, and given the faculty for operating, determination and patience enough to attend to the necessary details, together with certain opportunities, there is no reason why any qualified practitioner who is so minded should not attempt and achieve successful results in both.

The opinions given in this little volume are based principally upon the results of more than 100 cases given in detail (and illustrated as far as possible) in the Appendix. These are taken *consecutively*, not merely *selected*, and the mistakes as well as the successes are recorded, as a reader must gain much more benefit from studying the difficulties which others have met with than from a mere perusal of a list in which only the successes are recorded. For their previously published statistics and deductions on one or both operations the names of Charlier, Colin, and Cadiot in France, Fröhner, Möller, and Ostermann in Germany, Bang in Denmark, Degive and Hendrickx in Belgium, and Farmer Miles in England and America must always stand pre-eminent.

My thanks are due to Professor M'Fadyean for assistance in reading the proofs, to my partner, Mr F. H. Ridler, M.R.C.V.S., and to those gentlemen mentioned in the text who have kindly helped me in many ways, especially in regard to the illustrations. I have also to acknowledge the courtesy of Messrs Arnold & Sons in lending the woodcuts of various instruments.

F. H.

KENSINGTON, LONDON, W.

PREFACE TO THE SECOND EDITION.

UNFORTUNATELY, owing to pressure of work, this little brochure has been allowed to remain out of print for several years, but that a second edition of such a highly specialised subject as *The Castration of Cryptorchid Horses and the Ovariotomy of Troublesome Mares* should be demanded proves that the tendency for "specialising" in animal surgery is moving with the times in the same way as has been the case in human practice.

The second edition includes a most valuable and instructive chapter from the pen of Sir John Bland-Sutton, F.R.C.S., on the comparative aspect of the subject in its relationship to man and animals, and has also been enlarged to include castration and ovariotomy of all the domesticated and semi-domesticated animals; and the work of others, who too have specialised, has been freely acknowledged. In this connection my especial thanks are due to Mr Inglis, M.R.C.V.S., of Forfar, whose photographs illustrating the castration of cryptorchid sheep are unique, and also to Mr Stanley Elley, M.R.C.V.S., whose pioneer work on the caponing of ostriches has opened up a new field of profitable work in a very important branch of South African farming. To the Publishers of the *Veterinary Journal* and to Messrs Arnold & Sons I desire to tender my thanks for courteously giving me permission to use certain illustration blocks; and if the work meets with as favourable a reception as did the first edition I shall esteem myself more than repaid.

F. H.

KENSINGTON, LONDON, W.

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CHAPTER I.

CASTRATION.

THIS operation, by which is meant the removal of the testicles, is performed upon all varieties of animals, and is necessary wherever the males are required for work in company with others, especially where the sexes are mixed. Otherwise there is apt to be "trouble."

The principles to be followed are the same, but the methods of operating are varied somewhat to suit the respective classes of animals, the patients being starved for some hours previously.

Antiseptic methods are to be adopted, the instruments being sterilised and the parts cleansed. For the former there is no method better than simple boiling; and for the latter the parts may be shaved and scrubbed with ethereal soap and hot water containing disinfectant, or, better still, painted with tincture of iodine (or iodised chloroform), without any preliminary washing at all, the iodine being allowed to dry on.

CASTRATION OF THE HORSE.

This may be done either with the animal in the standing position or when recumbent, the position of the latter being either on the side or directly on the back.

Each has its advocates, and the man who is expert in his own method is sometimes apt to decry others, and to consider the one he adopts as the "one and only."

The Standing Position.

The "standing operation," for example, is undoubtedly as humane as any other when performed expertly, and although it has been described as "acrobatic surgery," it is really nothing of the kind when done quickly and properly. Occasionally one meets a case of difficulty either from the colt being of violent temper or the testicles insufficiently descended, but to those who are expert the operation is generally quite

Fig. 1.—Photograph showing the position of the operator in the standing operation.[1]

a simple one, and thousands of colts are satisfactorily operated upon in this way every year.

The method of procedure is as follows: The horse is pushed or backed into a corner and a twitch is applied; although very often this is dispensed with, the groom merely taking hold of the halter or head collar and shaking the animal's head or otherwise attracting its attention. Many operators prefer only one assistant, who is placed at the head, whilst

[1] For this photograph I am indebted to Professor Reynolds.

others prefer a man at the tail end pressing both hands on the haunch. The operator then takes up his position on the left side of the animal near the flank, and, stooping down, catches hold of one of the testicles with his left hand. It is usual to remove the smaller testicle first, as this can sometimes be drawn up almost out of reach if the horse becomes aware of what is about to be attempted.

Putting his left shoulder against the horse's flank, with the right hand the operator opens the scrotum and lets the testicle out with a sharp scalpel or castrating knife, drawing it boldly with a clean sweep along the median line of the testicle. The naked testicle is then exposed and the écraseur or emasculator used to remove it altogether; or, it may be that the operator is one who prefers a clam, and, if so, this is placed on the spermatic cord and closed. The clam may

Fig. 2.—A wooden clam.

be a clean, wooden one, used clean, or it may be dressed with some astringent or antiseptic.

A favourite dressing consists of finely powdered hydrarg. perchlor. (or cupri sulph.), which has been dusted over a thin surface of gum solution or gas tar (or pyroligneous acid), on the opposing surfaces of the clam and allowed to dry on.

The method of application consists of placing the clam on the cord, just above the epididymis, and drawing it together with the aid of a specially shaped pair of forceps, a leather cap or rubber ring being applied to keep it firmly closed. The testicle is then removed either with a knife or pair of scissors, and the colt taken to the stable.

The advantage of the clam is that the operation of removing the testicle is performed bloodlessly, but the disadvantage is that it is necessary to make a second visit the next day to remove the instrument.

With the écraseur or one or other pattern of emasculator the operation is completed at the time, the testicles being amputated in turn; or, with some practitioners who use the écraseur, it is the custom to include the two cords in the one loop and thus take them off together.

Whatever pattern of emasculator is used it will be found

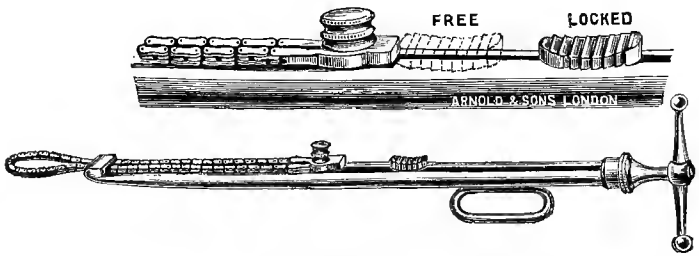


Fig. 3.—Ecraseur (Dewar's pattern).

a good plan to liberally apply carbolised vaseline to the edges before using, as this greatly lessens the danger of hæmorrhage.

It is not usual with the standing operation to wash the testicles, although some apply tincture of iodine with a brush and

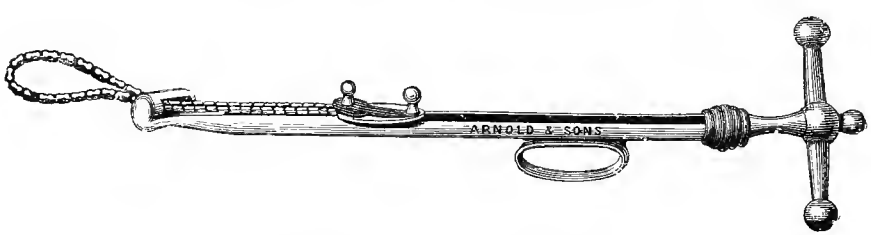


Fig. 4.—Ecraseur (Farmer Miles' pattern).

allow it to dry on before operating, and it is rare for trouble to occur from neglect to observe either of these precautions before castrating a colt.

Most of the difficulties of the standing operation occur if the operator handles the scrotum before actually operating, the colt becoming suspicious; otherwise, in many an instance, an expert operator has been timed to have the whole thing

finished and the testicles lying on the ground within three minutes from the moment the scrotum has been cut into.

As a general rule the colt will stand perfectly still, but sometimes one squirms or shrinks, and lies (or throws itself) down, whilst now and again one gets a determined colt who

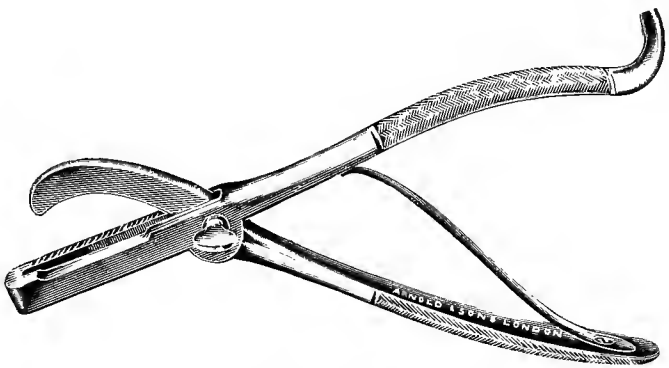


Fig. 5.—Emasculator (Blake's pattern).

kicks and plunges frantically, and has to be cast with ropes to be finished.

This latter is really the chief contingency which the operator hopes will not happen, and if nothing of the kind has occurred the colt will almost invariably walk straight away to the

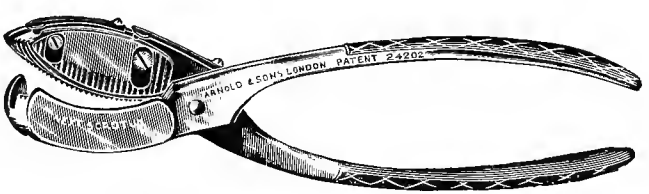


Fig. 6.—Emasculator (Reliance pattern).

manger and commence to feed, so that, judged by the impartial observer who has seen colts operated upon when cast and when in the standing position, it is not to be wondered at that the standing operation has its defenders on the grounds of humanity; as causing less fright and distress to the patient than takes place during the process of

casting and the necessary preliminary stage of excitement before complete loss of consciousness has ensued.

One must not forget, too, that if anæsthesia is incomplete there must be *some* pain given, also, that if the chloroform is administered by an inexperienced anæsthetist there is always a modicum of risk to be incurred.

This position is also possible in the "Vinsot" operating table, the chief inconveniences being that the colts have to be brought to the place where the table happens to be, and with those which have not been handled it is difficult to get them fixed, in addition also to the risk of injury from struggling. With the older horse, which has been handled, the matter of securing is easier than with the colt, and in France and America the operating table is an adjunct to very many veterinary establishments.

The Recumbent Position.

For castrating colts in this position the operating table may be used, either Vinsot's or Daviau's, but in Great Britain it is the usual practice to cast the patient on the ground, either in a grass field or on a straw bed.

Ropes and hobbles respectively each have their advocates, but the former are used to a much greater extent than the latter, and a rope can be expertly used in many ways to cast a colt.

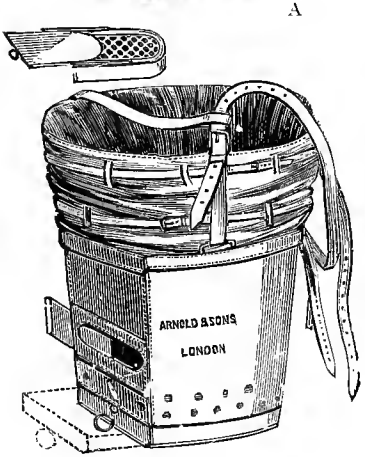
Some operators will merely take a long rope, made of cotton for preference (as it is a softer material than manilla), make a collar of the middle portion, and place it on the colt as shown in figs. 31 and 32, either with the knot on the wither or under the chest; whilst others will prefer the Hampshire method, for which a plain rope about 10 yards long is used. The manner of using (for a description of which I am indebted to Mr W. C. Hazelton, M.R.C.V.S.) is as follows:—

One free end is passed over the animal's back from the near side, and brought underneath, forming a loop round the body; the end is then secured to the near pastern by a running noose.

Two or more men take hold of the free end of the rope, the loop is

then slipped back over the quarters of the animal, and as it passes over the root of the tail the men are directed to pull quickly. This draws both hind legs together and lifts the near foot off the ground, the animal

A



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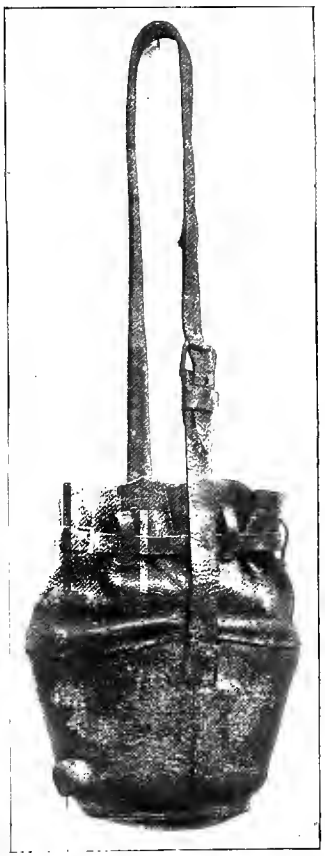


C

Figs. 7, 8 and 9.—Different patterns of chloroform inhalers—A, Cox's; B, Carlisle's (Raymond's improvement); C, Roberts' inhaler for chloroforming the colt in the standing posture.

then falling on to its near side. At this stage chloroform should be given if it is intended to administer it.

In the next stage the off hind leg is released from the rope and the near hind foot drawn up to the near fore one and secured by a half

hitch; the rope is then passed under the animal's body and both near feet drawn tightly into the near side; a loop of the rope is then passed round the off hind heel, which is drawn tightly into the off side and secured by a half hitch; the free end of the rope is finally passed round the near legs and the animal drawn on to his back, affording an ideal position for any operation in the scrotal region.

Another method of securing for castration, introduced to the profession by Mr T. H. Parker, F.R.C.V.S., and highly spoken of on account of the readiness with which it can be applied to

Fig. 10.—Rope applied to the near side feet ready for casting.

an unbroken colt and the convenient exposure of the abdomen and scrotal region, is illustrated in figs. 10, 11, and 12.

The rope is about 10 yards long, with an iron ring at one end, and greased with lard for about 3 yards from the ring in order to make it run better.

It is looped on the near-fore pastern and passed around the near-hind leg from without to within, being then twisted several times on itself and passed underneath to the off side. With a couple of men pulling on this, and with the assistance of the men at the head and tail, who push the colt over, the animal is easily made to pull on the near side, the men on the

rope then running to a position behind the hind-quarters as shown in fig. 11. A second rope is then looped over the off-hind pastern and passed over the front of the withers and under the neck, the off-hind foot being drawn up level with the off shoulder as tightly as possible; it is then passed over the fetlock rope and twisted once or twice around the hock, one man holding the end whilst the operation is proceeding.

Fig. 11.—Pulling the off hind leg into position.

As soon as the operation is completed the colt is speedily and easily released and is soon on his feet again.

Other operators will **anæsthetise the horse in the standing posture** without placing any ropes on at all until the patient falls over, when the upper hind leg is looped around the fetlock and the other end of the rope deftly passed under and around the neck, being twisted a couple of times over itself in such a way that the upper hind leg is drawn well forward and the testicle exposed sideways.

In any case when once the colt is fixed the **operation** itself only takes a few minutes, and is performed as follows:—

The testicles are painted with tincture of iodine or iodised

chloroform ; or, if the operator prefers it, they can be scrubbed and washed with hot water and ethereal soap. Grasping each testicle in turn with the left hand the operator makes a long incision through the skin, the tunica vaginalis scroti, and the tunica vaginalis testis, allowing the testicle itself to escape from its coverings. This is then removed, together with the epididymis, unless the latter is left at the request of the owner. Some owners like this to be left, the animal being generally

Fig. 12.—The off hind leg fixed, the patient now being in position for the operation.

more spirited in consequence, the term "cut proud" being commonly applied to this condition.

The methods of removal are various, being either by the écraseur, one or other of the patterns of emasculator, torsion, ligature, the clam and hot iron, or the wooden clam alone.

The **ligature,** although probably the most surgical, is the method to be the least recommended on account of the bad sequelæ which have followed its use, especially in regard to tetanus. With the **écraseur** and either of the **emasculators** it is not necessary to use a clam, the instrument merely being placed in position on the cord and the latter slowly squeezed through. Some practitioners cut through immediately above the epididy-

mis with a knife and twist the vessels of the cord upon themselves several times before applying the instrument, the idea being to lessen the danger of hæmorrhage. With the **torsion** method this is invariably done, and in this method of operating the vessels of the cord are seized with a metal clam, the parts below being slowly twisted round until they come off.

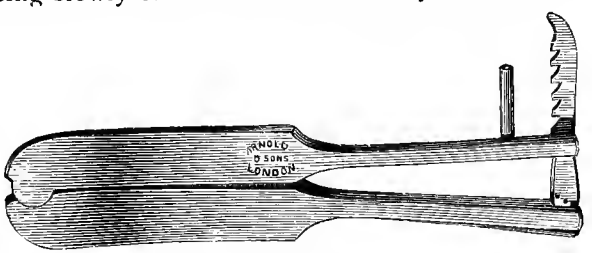


Fig. 13.—Castrating clam.

When the **actual cautery** is used the cord is fixed in its entirety in the clam and slowly seared through, care being taken that the iron is free from scales and not too hot. It

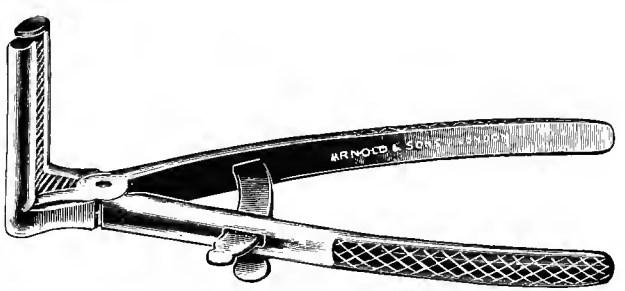


Fig. 14.—Torsion forceps.

serves the purpose of searing the vessels best when at a dull red glow and not at a white heat.

The After-Treatment is much the same whatever method is adopted. If a clam is left on, the colt is put in a clean loose box until removal has been effected. Otherwise, many are turned straight back to grass and the wound is never handled again. If kept in a box, care must be taken to keep it as clean as possible, to exercise the animal gently each day, and to douche the wounds with antiseptic solution.

CASTRATION OF THE BULL.

Calves are usually castrated at about three or four months old, and it is not usual to administer an anæsthetic. The animal may be cast or be operated upon whilst standing up, and here, as with the horse, each position has its advocates. If performed standing up the operator, having an assistant holding the calf's nostrils either with his finger and thumb or with the ordinary "bull-dogs," stands directly behind, and, after pressing the testicles upwards towards the groin, slits each in turn, or else cuts off the end of the "purse" and allows the two to be exposed together. The tunica vaginalis scroti is incised so as to expose the testicle itself, and the latter organ removed either by torsion, traction, or the clam and iron. In

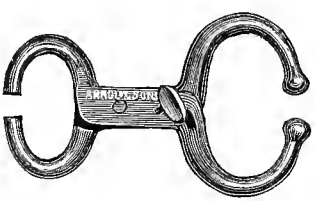


Fig. 15.—The "bull-dogs."

the author's opinion traction and torsion are the best, the clam and iron being next, whilst with the écraseur and emasculator there is always danger of hæmorrhage as a sequel. With the old or adult bull the clam and iron is the wiser plan.

CASTRATION OF THE RAM.

Young lambs are castrated when a few weeks old, and are usually operated upon by the shepherd, the method being crude and devoid of all attempt at asepsis. It is really astonishing how few deaths occur, and most country practitioners (and owners too) prefer to leave this work to these men, even going so far as to assert that with modern surgical methods there is often a greater percentage of fatalities.

As a rule an assistant sets the lamb between his knees on its rump, in the position most convenient for exposing the testicles, and the shepherd cuts off the end of the scrotum with a sharp knife, incises the covering of each testicle in turn so that it is exposed to view, and with the edge of his knife scrapes the spermatic cord through; or, more commonly still, he seizes each testicle in turn with his teeth and pulls on the cord until

Fig. 16.[1]—Photograph showing how the operator sits astride a narrow bench with the hind legs of the sheep under his thighs.

it ruptures through. Then (if he is a chewer of tobacco and has a savoury "quid" of that material in his cheek) he will very probably squirt or spit a quantity of salivary fluid into the wound before the lamb is turned loose!!!

The veterinary practitioner, if asked to do lambs, usually pulls them out or else scrapes slowly through each cord in

[1] For this photograph I am indebted to Mr G. H. Jelbart, M.R.C.V.S.

turn, or uses the clam and iron, and pours carbolised oil or some antiseptic in and around the scrotum.

The dangers to be feared afterwards are from shock, or from invasion of the malignant œdema bacillus and the tetanus bacillus respectively, as deaths from each of these causes are not uncommon. The chief thing to recollect is not to return the lambs to dirty folds, but to have everything as clean as is possible, to see that they are warm and well protected from the cold winds, and to keep them moving about for five or six hours afterwards.[1] Each of these precautions is very important.

For adult rams, or even well-grown lambs, the operation is always much more serious, and the practitioner should always warn his client that there is considerable risk incurred.

The safest way for the patient (and also the most brutal and barbaric) is to place a steel clam over the scrotum just above the testicles without incising the skin at all, and allow the whole of the portion underneath to slough off. This it does in from a week to ten days, and it is quite a rarity for a ram to die.

The second most successful way is to let out each testicle in turn, after cutting off the end of the scrotum, and remove them by traction until the cord gives way or with the clam and hot iron, taking care to stop all hæmorrhage. Those who have experience of this operation in sheep attach a great deal of importance to this precaution.

All other methods of emasculation, however modern or scientific, appear to give such a large proportion of fatal results that they have only to be tried once to be discarded.

CASTRATION OF THE GOAT.

In the goat the operation is performed in a similar manner to the calf, either by the clam and iron, torsion, or by applying traction on the cord until it gives way.

CASTRATION OF THE PIG.

This is generally, in Great Britain, done by the local "gelder," no anæsthetic or antiseptic being used, when the animals are

[1] "Veterinary Journal," June 1914 (P. Manuel, M.R.C.V.S.)

from three to six weeks old. It is rare for a death to occur. The manner of operating is as follows:—

An assistant seizes the pig by the hind legs and swings its body between his knees so that he straddles over its back and the scrotum is exposed to the operator. Each testicle is grasped in turn and the skin over it incised, the testicle after exposure being removed by scraping or traction.

In adult pigs or old boars, after the animal has been securely fixed, the scrotum is incised and each testicle is in turn removed by the clam and iron or by torsion.

The squealing of the animal and the unsavoury smell which permeates an old boar make the operation one which the average veterinary surgeon prefers to leave to anyone who will undertake it, and it is not often nowadays that old or adult boars are castrated, except by the "gelder."

CASTRATION OF THE DOG AND MONKEY.

This operation is frequently necessary in these animals in order to cure unpleasant sexual excitement, phymosis, or a tendency to wander. It is also necessary in certain diseased conditions, such as orchitis, tumour of the testicle, and for enlargement of the prostate gland.

Having narcotised the patient with morphia or anæsthetised with chloroform, the hair is shaved off the scrotum and the parts painted with iodine, the patient being placed on the operating table in the dorsal position. Each testicle is then exposed in turn by a longitudinal incision through the scrotum, the cord being ligatured or twisted several times upon itself and slowly scraped through. The scrotum may or may not be sutured at the discretion of the operator, but if there is no hæmorrhage it is quite possible to get healing *per primam*, the only after-treatment necessary being to paint the parts with tincture of iodine once or twice a day and to remove the sutures in about a week.

If necessary in the case of the dog to prevent the animal from licking the wound an Elizabethan collar is very useful.

CASTRATION OF THE CAT.

In the cat the operation is necessitated by the unpleasant odour of the urine of the uncastrated male, and by the tendency to wander and fight with other cats, especially at night-time.

Many thousands of cats are operated upon each year without any anæsthetic, the operation in the hands of a skilled expert occupying a matter of less than a minute, but the use of chloro-

Fig. 17.—Method of holding a cat for castration.

form, ether, or A.C.E. mixture should be adopted on grounds of humanity.

Where no anæsthetic is used the cat is held firmly by an assistant, or rolled up in an ordinary bath towel, or even a sack, whilst a still more crude and old-fashioned way is to put the animal head downwards in a top boot or the sleeve of an overcoat, care being taken not to produce asphyxia.

A good method of holding the animal is as follows: The cat is lifted up by the shoulder, the fore and hind limbs on each side being crossed over one another and grasped tightly. The first fingers are then crossed under the throat, and the thumbs are pressed firmly at the back of the head, in such a way that the cat cannot get its mouth down, or even sideways, to

use its teeth. The tail is pulled out of the way, and the hind legs held widely apart (*see* fig. 17).

When a general anæsthetic is used the cat can either be fixed on the operating table or anæsthetised under a glass bell jar. The testicles are removed by scraping or by traction.

CASTRATION OF THE RABBIT AND GUINEA-PIG.

Occasionally one is asked to castrate a rabbit or a guinea-pig, and the task is not always an easy one, although the testicles are of considerable size in the adult.

The difficulty in the former arises if one does not secure the two testicles at one and the same time; for the rabbit, when aroused and frightened, can withdraw the testicles almost out of sight, or at all events so tightly up against the abdominal wall as to make them difficult to obtain a hold upon. Once secured an incision is made over each one separately, and the testicle removed by scraping, torsion, or traction.

CASTRATION OF WILD AND SEMI-DOMESTICATED ANIMALS.

Occasionally a practitioner who has the veterinary care of a zoological collection or who includes amongst his clients the owner of deer and other beasts is requested to perform this operation, and the following is a plan which has been successfully adopted on the Duke of Bedford's estate in England by Mr Charles Powell, M.R.C.V.S., to whom I am indebted for the undermentioned description[1]:—

Antelopes and Deer are castrated in a similar way to large calves on a farm, viz.: Secure the head either by a noose round the horns, or, if these are absent, by a noose round the neck with a safety knot tied so that it cannot pull tight enough to cause strangulation. The end of this is then passed around a post or a ring in the manger and the animal's head drawn up tight. A casting rope is then passed round the patient's neck, the ends

1 "Veterinary Journal," February 1914.

pulled level, and a noose tied with a figure-of-eight knot, the latter resting on the top of the withers. The ends of the rope are then passed backwards through and around the hind legs and brought up on the outside, passing under the first line and then under the neck noose. The loop is then dropped on to the heel of each foot and the line on each side pulled tight. The rope securing the head is then loosened sufficiently for the latter to come down on the ground level with the rest of the body. The animal is then pulled down and over on its back and the legs secured by the ordinary method.

Castration is usually carried out with the clamp and actual cautery, the scrotum being opened on each side with a knife, the tissues of the testicle severed from their attachments and stripped for a little distance up the cord. Both cords are then enclosed in the clamps, severed and seared. They are then released, an antiseptic dressing such as a solution of kresophen or chinosol poured in the scrotal cavities, the rope loosened and the animal allowed to rise.

For these operations plenty of strength is necessary, and when the animal is down the operation should be performed as quickly as possible. The vessels of these animals sear very quickly and easily, and according to my experience no after complications occur.

In the case of some of the wilder animals, such as the **eland antelope,** the securing and casting is the most difficult part, and, owing to their great strength and activity, not altogether unattended with serious risk to the patient.

The method of procedure is as follows: The animals are first got into a yard with a shed. Leading from this is a narrow fenced passage leading along a row of boxes, each of which has a sliding door. The animals wanted are driven along this passage and secured in different boxes. The first animal is then got into the farthest box and the door pulled sharply to. A shutter window in the opposite side is then opened; this, also, has a cord by means of which it can be sharply closed if necessary. The attendant or keeper, who keeps

some distance from the window, manipulates a long wooden prop, on the end of which is adjusted the noose of a rope, endeavouring to drop the latter over one of the horns. This is a matter of difficulty and requires a lot of dexterity and patience to accomplish, the animal being almost as quick with its head as with its hind legs, and the attendant may have the prop sent flying out of his hands, getting a nasty jar in the bargain.

When one horn is noosed the animal's head is drawn up to the window by several men on the rope, and the other horn noosed with another rope. This latter is then thrown across the box to the door through which the animal entered, which is then opened and the rope taken and passed through a small opening in the boarded side of the right corner. By means of this the patient is then drawn over to the corner by men on the outside of the shed, the first rope of course being released. This is then thrown across and passed through with its fellow, and the animal is fixed. In the corner of the shed near to the shutter window is another door, which is opened, and several men enter carrying a shutter slightly larger than an ordinary door. The latter is pushed lengthways up against the side of the animal, which is thus pinned up against the side of the box. A rope is then passed round the animal's neck and the ordinary figure-of-eight noose made. The knot rests on the withers, the two ends passed backwards over the hind part of the animal, and assistants holding the end of each rope. They are then dropped down on each side, and, aided with a long iron rod with a hook at the end and by the kicking of the animal, are eventually got between the hind legs and drawn up to the thigh and kept tight by the assistants, who, needless to say, keep as far off the animal's reach as possible. All this is not done without a lot of trouble, as the kick of these animals is like a flash of lightning and delivered with immense force. When this is completed a noosed rope is got round each hind leg and drawn tight around the fetlock. The ends of these are then passed forward through the neck noose, pulling as much on the sternum as possible. The legs are

then drawn up to the noose, the animal let down and fixed in the usual way—or as near it as it is possible to get.

This method of securing and fixing the hind legs with separate ropes was adopted because it was found that when the ends of the casting rope were brought back through the

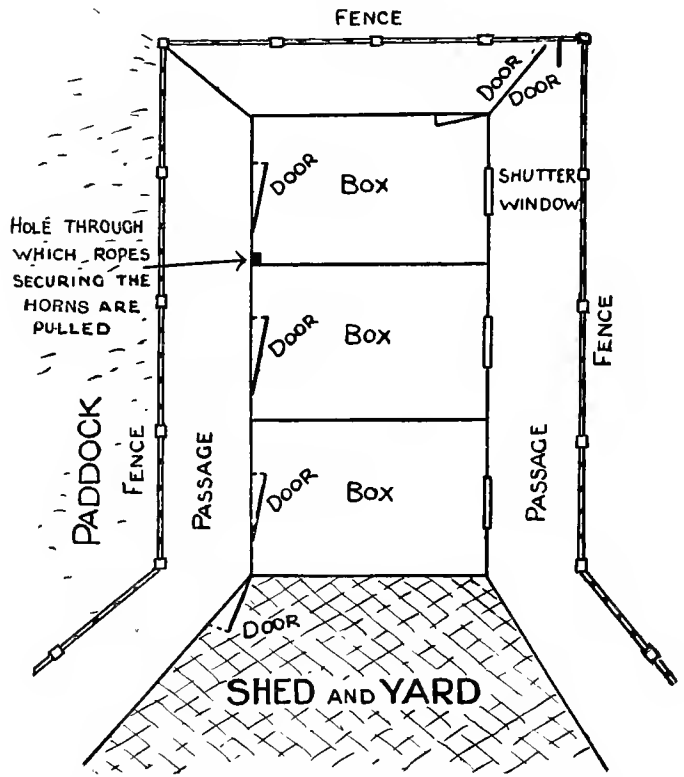


Fig. 18.—Plan of yard and boxes for securing antelopes and deer.

noose in the usual manner of side line casting there was, owing to the excessive struggling, great risk of strangulation occurring —these animals can almost tie themselves in a knot—and having a separate pull on the withers from behind tended to equalise the pressure and keep the noose well down on the lower portion of the neck.

The animal thus secured, castration is completed as follows:

The testicle, which is small, somewhat rounded and very firm in consistence, is then grasped firmly between the finger and thumb of the left hand, and the scrotum, the skin of which is very thin and smooth, incised with a knife and the testicle exposed, enucleated from its tunics, which are severed at their attachments and stripped up the cord for a couple of inches or so. This is repeated with the other testicle, and both cords grasped with the clamps, severed with the actual cautery and seared, released, and scrotal wounds dressed, the whole procedure being carried out as rapidly as possible. The animal may be very stiff for a few days after this, owing to its excessive struggling. They are very bad for this, as they do not give over fighting until completely exhausted, and will renew their efforts as soon as ever they recover wind.

The dangers with these are the risk of broken limbs, strangulation and heart failure. The latter may arise from the excessive exertion, especially as I have noted on *post-mortem* examinations of these species an enormous deposition of adipose tissue around the pericardium, which, however, appears to be a normal condition, but which if met with in horses or cattle one would almost call a lipoma.

The operation completed, the ropes are taken off. The attendants leave the box, and the ropes securing the horns are severed with a knife from the outside and the animal released.

Lions, tigers, and similar beasts are castrated in a similar manner to the dog, being first induced by food or compulsion to enter a strong box or cage, somewhat on the model of a lethal box, which is then rendered reasonably airtight, and into which the vapour of chloroform is introduced until unconsciousness supervenes.

Elephants are not castrated for various reasons, and it is rare, too, to see a castrated camel, although in this latter animal the testicles are visible enough if vicious propensities necessitate it.

Camels, however, even for Army transport purposes, are not looked upon, except for the work which can be got out of them,

with favourable eyes by white men, and their wants are usually attended to by their native drivers and owners.[1]

MISHAPS AND ACCIDENTS.

Apart from the ordinary accidents of casting and chloroforming one has to consider the risk of hæmorrhage after the operation, of peritonitis, tetanus, septicæmia, hernia, paraphimosis, and of mistakes made at the time.

Of the latter it is not unknown for the penis to be severed in mistake for testicle, and several instances of this have actually occurred both in the horse and cat.

One case, reported by Mr J. L. Perry, M.R.C.V.S., of Cardiff, is of especial interest.[2]

"An attempt at castration was made upon a cart colt, three years old, by an unqualified man, who took the first testicle away all right. On attempting to remove the other, the owner said that he "bunched up" something in the clam. Upon informing the man that this was not testicle the castrator said that the colt was malformed but that it was the other testicle all right. He seared through this 'something' with the hot iron, and immediately about 12 inches of penis fell from the horse's sheath on to the ground. Being thus convinced of his error, he then found and removed the other testicle.

"The injured parts swelled terribly, and for some time the horse was in a critical condition, but eventually recovered sufficiently to work, although suffering from stricture and incontinence of urine."

The methods of dealing with the other complications are given in Chapter III.

TUMOURS AND ABNORMALITIES.

Tumours and other abnormal conditions very frequently occur in all animals, and the veterinary practitioner is often called upon to deal with them, especially in the horse and dog.

Details of these conditions in the horse are dealt with at length in Chapter III., the most common being **sarcoma, embryoma,** and **fibroma,** whilst **lipoma** has also been met with on one occasion.

[1] The Somalis sometimes indulge in camel flesh as a luxury, and the "eating" camels are castrated for fattening purposes.

[2] "Veterinary Journal," September 1910; "American Journal of Veterinary Medicine," May 1911.

In the dog **enlargement of the prostate gland,**[1] sometimes due to tumour formation, is by no means uncommon after six

Fig. 19.—Aged wire-haired terrier with ectopic left testicle and chronic orchitis.[2]

Fig. 20.—Aged Irish terrier with sarcoma of the testicle.[2]

[1] *See* p. 83.

[2] For the photographs of figs. 19 and 20 I am indebted to Mr Henry Gray, M.R.C.V.S.

or seven years old, and for this condition and its accompanying painful symptoms castration is almost a panacea.

In the farm animals, probably on account of their comparatively short lives, tumours are not so common, but in the dog

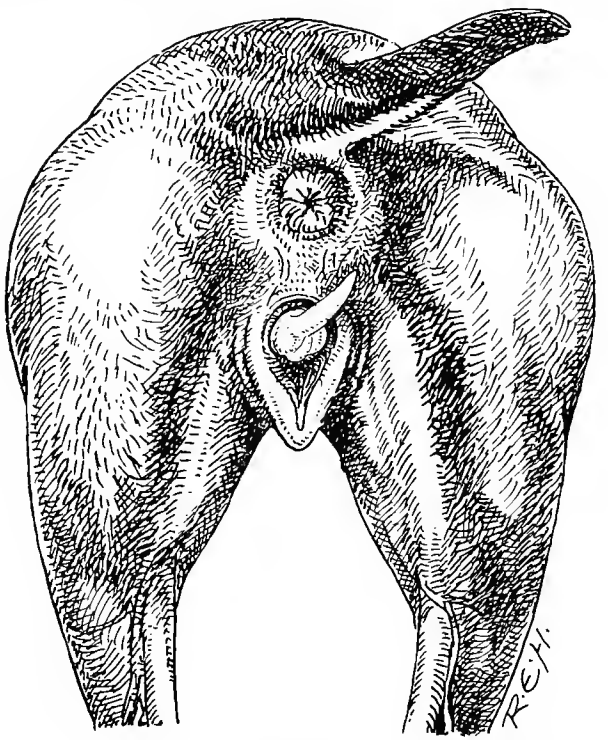


Fig. 21.—Sketch taken from the hind parts of a hermaphrodite pug puppy five months old.[1]

and cat (especially the former) tumours (especially sarcoma and carcinoma) are often seen.

Orchitis, too, is common in all animals, the testicle sometimes attaining an extraordinary size.

The only remedy in each instance is a complete castration, this being done, if possible, in the case of the tumour patients before the glands of the groin have become infected; and in the case of the orchitis patients after the inflammation of the

[1] Figs. 21 and 22 are taken from "Canine and Feline Surgery," published by Baillière, Tindall & Cox.

parts has been sufficiently subdued by the application of the usual sedative remedies. Of the latter there is nothing which

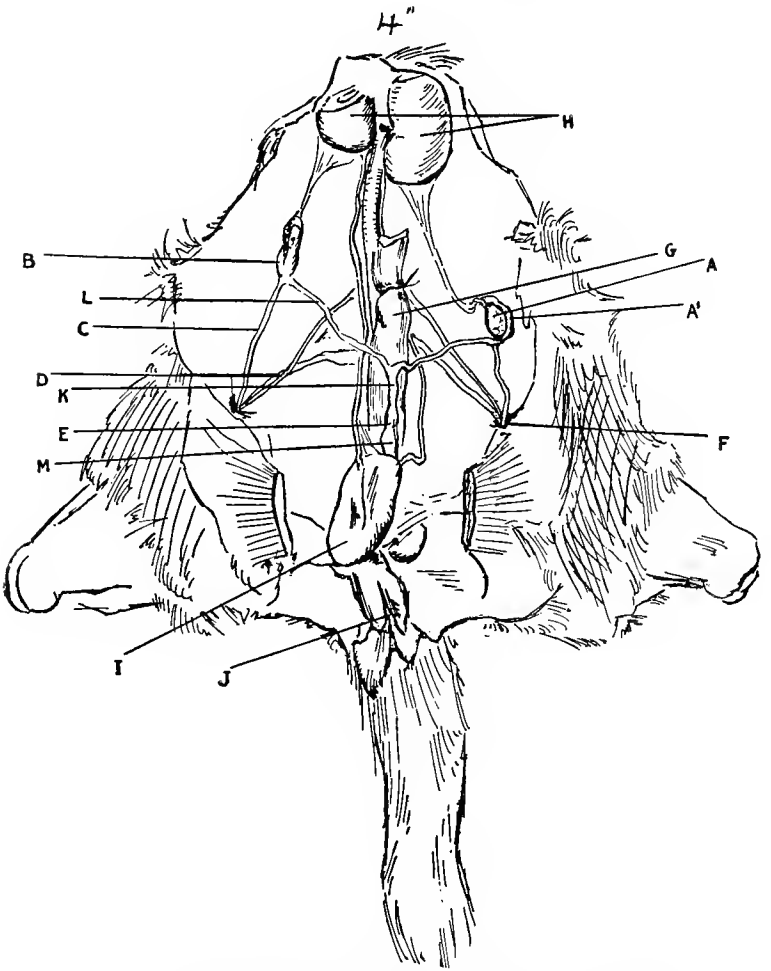


Fig. 22.—Dissection of the internal generative organs of the pug puppy illustrated in fig. 21.

A, Left testicle; A' Epididymis; B, Right testicle; C, Gubernaculum testis; D, Femoral vessels; E, Os uteri; F, Internal abdominal ring; G, Rectum; K, Kidneys; I, Urinary bladder (reflected); J, Vulval opening; K, Body of uterus; L, Cornu; M, Vagina.

gives greater ease than hot applications followed by sedative lotions such as those of opium and lead or lead and zinc.

True **hermaphroditism** is met with in all animals, as also are

cases of arrested development. Figs. 29 and 30 illustrate this in the horse, and figs. 21 and 22 show this condition in the dog.

Mr C. J. Davies has written a very interesting article[1] on the occurrence of this condition in certain strains of goat, and the Museum of the Royal College of Surgeons has a very fine dissection specimen illustrating it clearly.

In the patient from whom these sketches (figs. 21 and 22) were made the animal became objectionable on account of its amorous propensities and the persistent protrusion of an abortive penis (or enlarged clitoris), which was successfully amputated.

LIGATURE OF THE VASA DEFERENTIA.

Shattock and Seligman[2] performed a number of interesting experiments on the common fowl and on a particular variety of sheep (Herdwick breed, the female of which is destitute of horns), the operation being carried out in the young and immature state; and their results have a most important bearing on what might be done by an unscrupulous vendor of pedigree stock.

They found that when the *vasa deferentia* were ligatured the male bird acquired its full plumage, with comb and spurs, and the sheep acquired horns as in the intact animal. The testicles grew to full size and spermatogenesis proceeded normally. Potency was not destroyed although fertility was, of course, rendered impossible, thus pointing to the production of an internal secretion by the testicle which brings about the appearance of the external or secondary sexual characters.

These facts are ones which all veterinary surgeons should be aware of, as the operation is not a difficult one to perform, and can be done so neatly that the resulting scar is quite unnoticeable when the animal is standing up; and even when cast and carefully searched for it is often quite impossible to detect after a few months have elapsed.

A small incision just above the epididymis suffices to enable a catgut ligature to be placed around the *vas deferens*, care being taken not to injure any of the vessels or other structures; and the skin can be sutured and treated antiseptically so that a primary union is assured.

[1] "Veterinary Journal," 1912.

[2] "Transactions of the Pathological Society of London," 1905, Vol. LVI.

CHAPTER II.

SCROTAL HERNIA.

SCROTAL HERNIA is met with in all animals, although the veterinary surgeon is more called upon to treat it in the horse, dog, and pig than in any other variety of his patients. It is not common in the cat, and if occurring in the bull (*see* fig. 26A) or ram the animal is not usually allowed to propagate his species but is fattened up for food.

Its Heredity is unquestionable, and in this fact lies its extreme prevalence amongst horses and dogs, and it is also an indisputable fact that it can be transmitted through the dam. On these grounds animals with hernia ought never to be put to the stud.

Those engaged in large canine practices will meet with it in all breeds, but especially in the pet varieties which happen to be the prevailing fashion at the time.[1] In size the hernia may become very large, sufficiently so as to make a horse useless for work, or a dog unable to run along without pain or great discomfort,[2] and the risk of strangulation is constantly present if intestine is in the sac.

The Contents of the Sac usually consist of omentum and intestine (or both), and the "dragging" pain is often evidenced by the loss of condition in the patient and by the inability to undergo severe exertion. These two points are of the utmost

[1] At the present date (1914), for example, it is seen more commonly in the Pekingese than any other breed.

[2] In the horse one may sometimes see a case in which the hernial sac is literally as large as a stable bucket and falls to the level of the hocks; and in the dog it will sometimes touch the ground as the animal walks along.

importance for the practitioner to bear in mind when discussing with a client the purchase of an animal with a rupture of the scrotum, however slight at the time.

The methods of operating differ in the different animals, and there are also slight modifications to be observed in the methods of operating upon those which have been castrated

Fig. 23.—Scrotal hernia in a foal.[1]

and those which are still uncastrated. For descriptive purposes it is better to consider each class of animal separately.

SCROTAL HERNIA IN THE HORSE.

This may be met with in the gelding as well as in the uncastrated animal, and the principles of operation in each case are the same, in that an endeavour is made to cut through the skin alone and return the contents to the abdomen without actually opening the hernial sac itself; the

[1] For this photograph I am indebted to Mr A. D. Lalor, M.R.C.V.S.

object of this is that the abdomen shall not be actually entered.

In some cases, however, this latter is impossible on account of the adhesions which have formed, and the sac itself has to be opened in order to break down those which have formed between the intestine and the sac wall. It is scarcely necessary to say that the danger of peritonitis is much less when the sac has not been opened.

The animal is cast with ropes and chloroformed, being placed in the dorsal position and retained there by the aid of assistants and with the support of a couple of sacks filled with straw, one placed on either side. The scrotum is then painted with iodine, which is allowed to dry, or thoroughly cleansed with ethereal soap and hot water. The operator

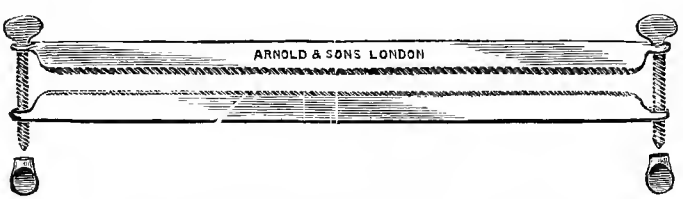


Fig. 24.—Scrotal hernia clam (Captain Russell's).

grasps the testicle firmly with the left hand in such a manner that the skin is tense over it, and with a sweep of the scalpel carefully incises this and the *tunica vaginalis scroti* only. This leaves the testicle still covered by the *tunica vaginalis testis*, and every endeavour should be made not to enter this. With the finger and some blunt instrument (such as the handle of a scalpel) the operator then separates this tunic away downwards as far as possible along the testicular cord to the inguinal ring, the cord and the testicle still being within their covering. When *quite* sure that the neck of the sac contains nothing but "cord," and that the intestine is all pressed back, an assistant fixes a clam in position, and when this has been done the portion below (which includes the testicle) is amputated. The clam must be affixed firmly and securely, and is then left *in situ* until it

drops off, an event which usually happens in about eight or ten days.

Some practitioners use a stout ligature for the hernial sac, but the clam is undoubtedly safer.

With the uncastrated animal the hernial sac is cut down upon and the clam affixed in a similar manner, the same care being taken not to include a loop of bowel. A piece of omentum is not of such vital importance, although this is best avoided as it can act as a means of infection.

The Presence of Adhesions complicates matters very much (these are more commonly met with in the gelding than in the stallion), and the intestines are often so "matted" together and adherent to the side that to separate them sufficiently in order to drop them back into the abdominal cavity is difficult. For this the sac must be opened and the adhesions severed with the utmost care by the aid of the fingers and some blunt instrument; and when once they are replaced the operator must decide whether to suture the inguinal canal, or whether to fix a clam on the outside of the sac. The latter is the plan preferred by the author wherever possible. Once the clam is in position it is allowed to stay there until it falls off, as already previously mentioned.

The After-Treatment consists in keeping the animal in a large, clean, airy, loose-box, and syringing the wound with antiseptic solution until healed.

The Prognosis is excellent wherever the abdomen has not been entered, and indeed when the abdomen has been entered if asepsis has been possible. It is obvious, however, that in these latter cases there must be some risk of peritonitis both at the time of operating and afterwards, for the veterinary surgeon, however careful he may be, is very severely handicapped when compared with his human *confrère*.

SCROTAL HERNIA IN THE DOG.

The influence of heredity has made hernias of all kinds quite a common occurrence in certain breeds of dog, especially

the Pekingese, which happen at the present moment to be fashionable. It is traceable to certain strains in which a sire or a dam possessing good show points has been used at stud. The mischief is widespread, for it can be transmitted without the actual parent being visibly affected, thus missing a generation and being a reversion to a previous grandsire or granddam. All the varieties of hernia can be transmitted in this

Fig. 25.—Scrotal hernia in a dog.[1]

way, but it is only with operation upon the scrotal that we are dealing here.

It is usually visible at birth or within a few weeks afterwards, and may temporarily disappear, reappearing again at puberty or in later life. As time progresses it increases in size, and may even become so large as to interfere with progression, causing the patient considerable discomfort and pain.

In the dog the contents of the sac usually include small intestine, and it is for this reason that great care is necessary in regard to dietary, in order to prevent strangulation if the owner decides not to allow operative interference.

[1] This photograph is taken from "Canine and Feline Surgery," published by Baillière, Tindall & Cox.

There are two ways by which the condition may be treated surgically, one, by merely returning the intestine into the abdomen and ligaturing the lower end of the scrotum, and, secondly, the "radical" operation.

In any case the operation should be done under the influence of either morphia or chloroform. The former has the advantage of keeping the dog quiet for some hours after

Fig. 26.—Scrotal hernia.[1]

the operation, and gives ample relaxation of the muscular tissue for the proper performance of the operation.

To apply the ligature the dog is placed on its back and the scrotum painted with iodine. The contents of the sac are returned to the abdomen, so that the testicle is pressed lightly against the inguinal ring, and an assistant then ties an antiseptic silk ligature around the scrotum just below the testicle or testicles. This ligature is allowed to remain until

[1] For this photograph I am indebted to Mr Henry Gray, M.R.C.V.S.

the portion underneath falls off (about eight to ten days), when the wound which results is treated antiseptically until it has healed. For three or four days the scrotum swells very much, but beyond showing temporary inconvenience the animal does not appear to mind it much. This operation does not always result in *complete* disappearance of the hernia so that an expert would not detect it, but it will often make it so much less that the discomfort and pain is removed, and it is not noticeable unless looked for.

In the "Radical" Operation the scrotum is incised, the intestine is returned, and the internal inguinal canal sutured.

As a rule it is necessary, unless the testicle can be returned into the abdomen, to castrate the dog, it being very difficult in the generality of cases to suture the inguinal ring in such a manner that there is no pressure put upon the spermatic cord, a contingency which would cause more pain than the original hernia.

"Ten-day" catgut sutures are preferable for the inguinal canal, the advantage over silk being that "buried suture" trouble does not occur afterwards, and silkworm gut for the outside.

It is only in rare cases that a bandage is necessary afterwards, the parts being merely painted with iodine each day and the patient kept in a clean kennel.

It is usual to get healing by primary union, the outside sutures being removed about the sixth or eighth day.

SCROTAL HERNIA IN THE PIG.

This condition is very common and is well recognised by the castrator. It is usually treated by him in a very haphazard surgical manner, the scrotum being opened without anæsthetics or even the application of any antiseptic, the testicle scraped off, the intestine returned (an assistant holding the pig upside down between his legs), and the scrotum sutured with a needle and some string or thread.

In the majority of cases the pig runs off to join its fellows

on the manure midden, but a wise owner will keep the animal quietly in a clean place for a week subsequent to the operation. The sutures are usually left to take care of themselves and eventually fall out.

The chief precaution to observe is to have the pig well starved for at least twenty-four hours beforehand, and to allow only half rations for a week or ten days afterwards.

Fig. 26A.—Scrotal hernia in a calf.[1]

[1] "Veterinary Journal," July 1907 (Harold Mason, M.R.C.V.S.).

CHAPTER III.

THE CASTRATION OF CRYPTORCHID HORSES.

Definition and Reason for Operating.—By the term "cryptorchid" is understood an animal that has one or both testicles hidden from external view. If one is out of sight the animal is said to be a unilateral cryptorchid or **monorchid**[1]; if both are hidden then the term bilateral or double cryptorchid is applied. The agricultural community know an animal of this kind better under the name of "**rig**" or "**ridgling.**" The terms "retention of the testicle" or "undescended testicle" are more commonly applied by our medical *confrères* to a similar condition in human patients.

In the patient from which fig. 27 was obtained the right testicle was quite twice the normal size, and present in the scrotum. When removed it weighed 12½ ozs., measured 6 inches from end to end, and had a circumference of 9 inches at its widest part. This was removed with the écraseur, and gave a good deal of trouble owing to subsequent hæmorrhage. The left inguinal canal was then explored and the abdomen entered.

A careful search failed to discover any trace of the missing organ, and, recollecting my previous experiences, I ventured to assert that there was not another testicle present.

The blood vessels in the inguinal and scrotal regions were abnormally developed, and although we left the animal apparently all right, uncontrollable hæmorrhage set in on the following day, and death took place on the evening of the second day after.

A *post-mortem* examination made by Mr T. D. Hughes, M.R.C.V.S., and myself revealed that the hæmorrhage had undoubtedly been the cause of death. There was no sign of epididymis or testicle on the left side, the abnormality being as here illustrated. There was just a small, thin, atrophied cord, and from the fundus of the bladder the vas deferens could

[1] "Veterinary Journal," September 1910 (Hobday); "American Journal of Veterinary Medicine," October 1910.

only be traced for a few inches, when it imperceptibly disappeared into the peritoneum.

Professor M'Fadyean kindly examined the specimen.

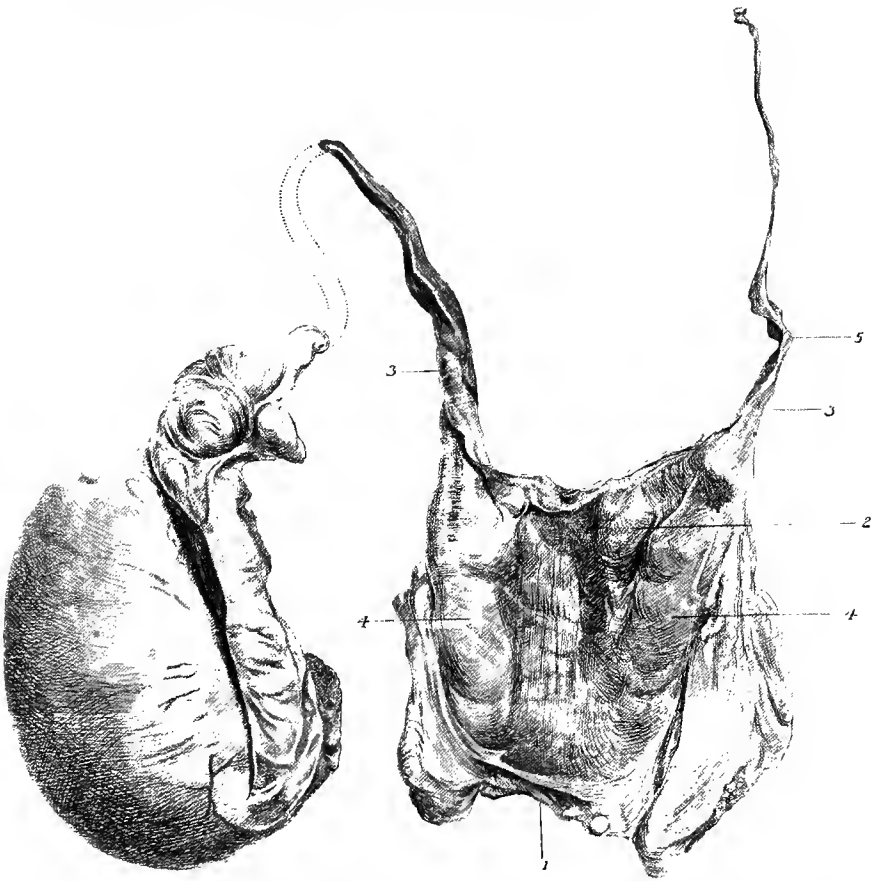


Fig. 27.[1]—Abnormal organs of a monorchid, showing the scrotal testicle and the portion of the generative organs present on the other side beyond the fundus of the bladder (half natural size).

1. Fundus of the bladder; 2. Fold of peritoneum uniting the vasa deferentia; 3. Vas deferens; 4. Bulbous portion of the vas deferens; 5. The vas deferens on this side was pervious as far as this point.

This animal had been bred by its present owner, and no attempt at castration had previously been made.

Cryptorchidism may exist in any of the domesticated animals,

[1] "Journal of Comparative Pathology and Therapeutics," Vol. XIII., page 367.

and has been observed in the horse, bull, pig, ram, dog, and cat. Probably it is more frequently operated upon in the horse, dog, cat, and pig than in any of the others. The removal of this hidden testicle is, in the majority of instances, a matter of necessity, especially in the horse, as the animal may at any time display a vicious and treacherous disposition. I have had one instance in which a cryptorchid horse had worked quite quietly for three years, but one day, without any warning, the animal suddenly turned upon its driver, knocked him down, and bit him savagely. In any case, even if not vicious, a "rig"

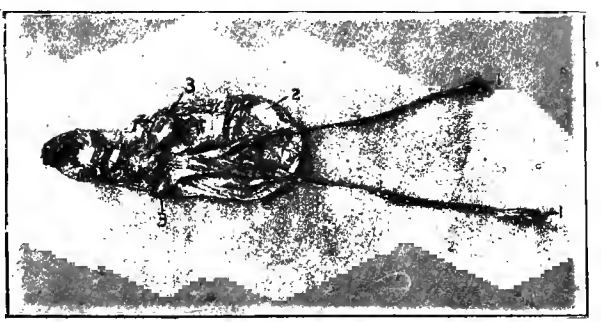


Fig. 28.[1]—Abnormal genito-urinary organs of an anorchid colt.
1, 1. Small masses of fat in the position of the testicles; 2. Urinary bladder; 3, 3. Vesiculæ seminales.

colt is a nuisance to its owner, because it will constantly be trying to get at the mares and is uncertain with other horses, being therefore unable to be turned out to grass. The external form, especially about the neck and head, becomes somewhat like that of the stallion, although this rule is not constant.

A condition is occasionally met with in which no testes are present at all.[2] Such an animal is technically known as an **"anorchid."**

The animal from which fig. 28 was obtained was a freak of nature and had no testes at all. It was a valuable thoroughbred belonging to a well-known nobleman, in whose stud it was bred, and had been sent to New-

[1] "Journal of Comparative Pathology and Therapeutics," Vol. XIII., page 75.
[2] *Idem.*

market for training. It had always shown a want of development of the penis, and this organ had never been "drawn," the urine always coming in contact with the prepuce when it was passed. No signs of either testicle were present externally, and the horse had never been seen to show any sexual desire, the animal being of an usually quiet disposition.

The inguinal canals were explored without result and the abdomen entered. No trace of anything with the characteristic form or feel of testicles could be detected during an hour and a half's careful search. The wounds were then sutured and restoratives applied, but death occurred about eight hours later from exhaustion (the bones of the spine were afterwards boiled to make sure that no fracture existed).

Post-mortem examination (made by Mr Potts, M.R.C.V.S., and myself) revealed the penis to be unusually small, whilst lying close along the under surface of the loins were the spermatic cords (or what represented them), each being much shorter and thinner than normal and terminating in a small bulb of fat. Of the latter, that on the left side was a little larger than a kidney bean, and that on the right hardly as large as a haricot bean.

Professor M'Fadyean kindly made a microscopical examination of the terminal portions, and informed me that there was no sign of testicular tissue present, the endings being merely adipose material.

I distinctly recollect applying traction to the fatty lumps on two or three occasions whilst my hand was in the abdomen, but I could not make up my mind that they were the representatives of the testicles, particularly as, owing to the shortness of the cords, I could not withdraw them a sufficient distance from the loins to bring into view or get them within reach of the écraseur chain.

Many apparent hermaphrodites have predominating male tendencies, and prove upon exploration to be cryptorchids, being in reality cases of "arrested development." In some parts of England a horse with this malformation is known under the name of a **"will-gill"** by the farmers.

The animal from which these photographs (figs. 29 and 30) were obtained was three years old and of the Suffolk cart horse breed.[1] It possessed a small, thin penis, which measured (when extended) 9¼ inches long, and protruded backwards in the perineal region in the usual situation of the vagina in a mare.

When in contact with another animal, either horse or mare, the penis would become protruded and erect. Urination took place through this organ, the stream being directed backwards. There was no sign of scrotum, and in its place was a mammary gland with well-developed teats.

Thinking that the animal showed more male than female proclivities, it was cast and secured as for cryptorchid castration, and, under antiseptic

[1] "Journal of Comparative Pathology and Therapeutics," Vol. XII., page 336 (P. Turner and F. Hobday); "Veterinary Journal," 1908, page 566 (F. D. W. Oatley).

precautions, the inguinal canals were explored. In each case a tolerably large testicle was found. Both were well out of sight and close to the internal abdominal rings. They were removed with the écraseur and recovery was uneventful. The horse has since been as quiet and tractable as any ordinary gelding.

Heredity.—There can be no question upon this point. The tendency for a horse with one testicle retained and one in the

Fig. 29.[1]—External genitals of hermaphrodite (photographed when the animal was standing).

scrotum to produce progeny having a similar defect is well illustrated in districts where a stallion with only one testicle visible is allowed to be used at stud. It is possible, too, that atavism plays some part in this malformation, for I have met with, at all events, two authenticated instances in which the tendency appeared to come from the mare's side.

1 For photographs (figs. 29 and 30) I am indebted to Mr G. Haskell, M.R.C.V.S.

Two colts, five years and three years old respectively, each with an undescended abdominal testicle, were out of the same mare, but by different sires. Curiously enough, too, there was the coincidence of both being on the right side. Both the sires were well developed, and no more "rigs" have been got by them in the neighbourhood. The dam has only had one other foal, that being a filly. The mare has no known "rig" relatives but her two offspring.

In another instance a two-year-old (inguinal), a five-year-old (left abdominal), and a seven-year-old (right abdominal) were by the same stallion, out of different mares. The dam of the first one only bred two colts, and both were "rigs." They were by the same sire. This sire, a cart stallion, has been in the present owner's possession for twelve years. He is decidedly not a "rig," nor has he any known "rig" relatives except as regards his own colts. With reference to them the owner wrote me: "We have bred quite fifteen colts from this particular sire, and four of these were 'rigs.' We have heard of no 'rig' colts amongst the stock of the other farmers who have used him as a stallion. We have the stallion now; he is a sure foal getter although seventeen years old."

The fact that two out of the four were from the same mare is certainly, when added to the other instance, worth special observation.

Power of Procreation. — When one testicle is visible the animal may be quite as good a stockgetter as when both are present, but when this has been removed, or when the testes are in the inguinal canal or the abdomen, the probability is that (although the sexual instinct is very marked) the animal is unable to propagate its species.[1] When examined microscopically after removal it is not rare to find spermatozoa in testicles which have remained in the lower part of the inguinal canal, but in those found in the upper part, and in those taken from the abdomen itself, this is exceptional.[2]

In fourteen instances Professor M'Fadyean microscopically examined and reported upon testes which I had taken from the abdomen, and spermatozoa were discovered twice. In eleven testes taken from the inguinal canal five contained spermatozoa. Three of these were at the extreme upper portion of the canal, and all were beyond dispute in such a position that they could be termed "inguinal" testicles. They were quite out of sight even when the patient was cast and secured on its back.

Fertility, however, depends upon many things, including the number and state of maturity of the spermatozoa; the actual

[1] This statement is made after very careful enquiries from numerous owners of cryptorchid horses, dogs and cats whose animals were found upon operation to definitely have the testicles in the abdomen.

[2] *See* page 158.

presence, therefore, of a few specimens in the semen removed from a testicle does not necessarily imply power to propagate species.

Preparation of the Patient before Operation.—The disadvantage of an engorged condition of the digestive organs is too obvious to need much comment, and for any operation involving exploration of the abdominal contents the advantage of a few hours' fast cannot be too strongly insisted upon. In

Fig. 30.—Appearance of the external genitals and mammary gland when the hermaphrodite was cast.

fact, cases have been recorded where operators have failed to discover the retained testicle in a patient which has not been fasted, whereas a few weeks afterwards the horse has again been cast after being starved for twenty-four hours, and the testis has been discovered without difficulty.

No food should be allowed for about twenty-four hours before the time of operating, and water should only be given in limited quantity. Even this should not be given within five or six hours previously. Care must be taken that the bedding is not

eaten, the animal being tied up short or made to wear a muzzle.

As to the advisability or otherwise of the previous administration of a dose of physic, opinions differ a little. Personally I do not consider it necessary except in special circumstances, as a laxative diet prescribed for a few days before and after the operation is quite sufficient and the patient is not nauseated. It seems theoretically, and practical experience has borne it out, that it is better to operate upon a patient in

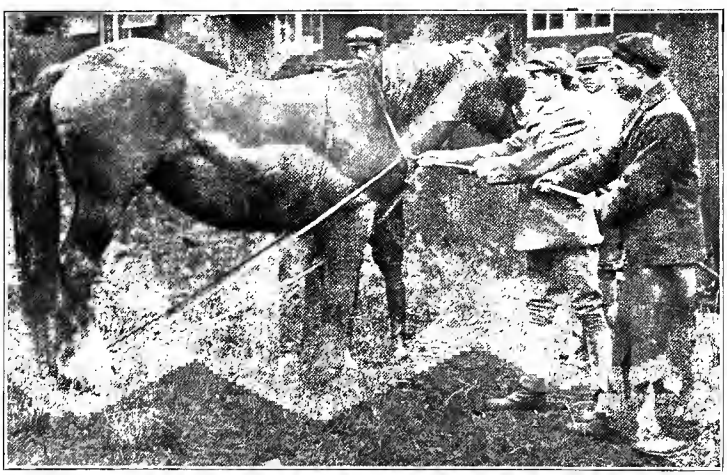


Fig. 31.—A plain waggon rope and ordinary halter adjusted previous to throwing the animal.[1]

good spirits and in good health rather than one whose system has been depressed and depleted by a strong purgative. In any case, if a laxative is used, a mild dose of magnesium sulphate or oil is preferable to any drug such as aloes, which causes nausea and depression. An enema an hour beforehand is sometimes a useful adjunct, although in restive colts which have not been handled it is objectionable, the better plan being to disturb them as little as possible before casting for the actual operation. The hair of the tail should be plaited up or otherwise secured, so that it does not unexpectedly swish round and foul the operator's arm or the site of operation.

[1] For photographs of figs 31 and 32 I am indebted to Mr W. C. Hazelton, M.R.C.V.S.

Methods of Securing.—The methods of securing for the cryptorchid operation vary with the fancy of the operator. A cryptorchid can be castrated when fixed either on its side or on its back. When the lateral position is chosen the animal is cast either with rope or hobbles, the upper hind leg being fixed well forward in such a way that the operator can get the maximum amount of room in which to work. The side on which the hidden testicle is supposed to be is placed upper-

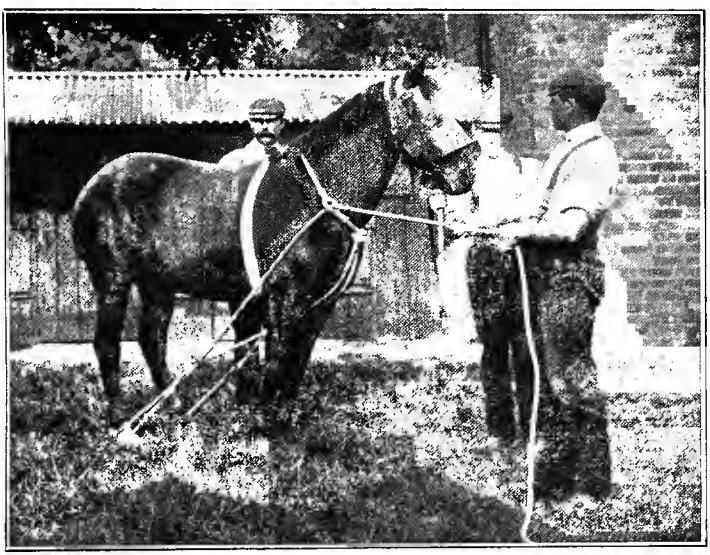


Fig. 32.—Rope with metal eyes, affixed for casting.

most. The disadvantages of this position are that there is certainly less room in which to work, as the weight of the upper leg is in the way, the hand and arm of the operator are more likely to touch parts of the body which are not surgically clean, the field of operation is not so visible, and, in addition, when the history of which testicle has been removed is doubtful or unknown, the search for the scar (unless the animal has been previously turned on its back) is more difficult. It is not so easy, too, to avoid injuring the large plexus of veins which are

to be found in the inguinal region. The only advantage which can be claimed for it is that the risk of protrusion of intestine is not so great when the operator is not using a general anæsthetic.

With the dorsal position, and this is by far the most convenient, the patient is cast with a rope just as for ordinary castration. With a manilla or cotton rope about 50 feet long a loop or collar is made in the centre and passed round the neck, the loose ends are passed between the fore legs, through the hind ones, brought up around the heels and passed through the rope collar, or through metal eyes previously inserted in the strands of the rope (*see* figs. 31 and 32).

The rope, after leaving the heel, may or may not (at the fancy of the operator) be twisted once on itself before it is passed through the collar (*see* fig. 32).

One man attends to the twitch and head, his instructions being to sit on the neck as soon as the colt falls on his side. A sack loosely filled with oats is a very useful adjunct to keep the animal quiet if placed over the neck. Two or three men, depending upon the size of the patient, are placed on the rope at either side, being *outside* it and not between the colt's body and the rope on account of risk to themselves during the fall. They may be all instructed to walk backwards; or, if the colt is to fall on his off side, those on the right rope stand still or walk slightly forwards, whilst those on the left walk and pull backwards, running behind the animal's quarters when it falls. Whilst the under rope is kept tight the upper hind leg is pulled as close to the body as possible; the operator, or his assistant, passes a loop of the top rope over the hind heel, pulls it tight again, and fixes it with a couple of half hitches. The upper fore leg is then secured alongside the hind one, either inside or outside, with half hitches, and a final half hitch over the hind heel completes the tying of that side. This rope is given to a man to hold. The colt is turned over and the other side tied up in the same way.

Place the colt on his back and a bundle of straw (or a sack

filled with straw) on either side, and the patient is now ready for operation.

If preferred the fore legs may be tied separately by passing a slip noose of rope, the leg being bent on itself, round each one (*see* fig. 33).

Some practitioners prefer the knot of the collar to be on the withers, the ends of rope then being passed straight away along

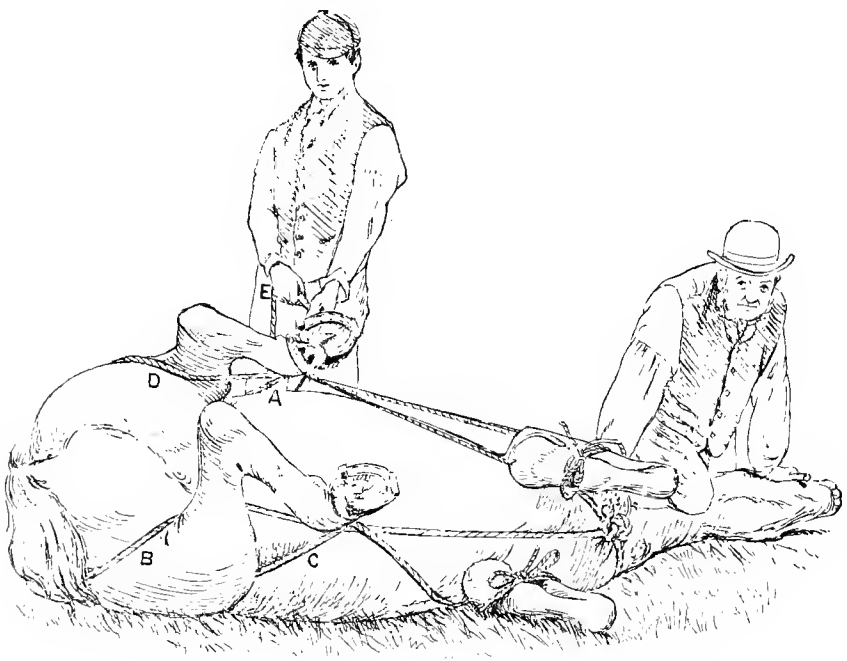


Fig. 33.—Cryptorchid colt secured in position by Mr Donald's method.

the flanks and through the hind legs as above directed. If the first-named method is chosen, a rope or surcingle should always be put round the chest behind the elbows and the collar of the rope firmly tied to it (*see* figs. 31 and 32), or the animal will sometimes withdraw its head, and so necessitate the trouble of untying and recasting.

Farmer Miles, who was probably the first to introduce the "rig" operation into England, had a special set of ropes and

an elaborate method of fixing, whilst the Danish method is also somewhat complicated. The main object of each way is to spread the legs out well, so as to open out the inguinal region as much as possible, and this can be done quite readily with an ordinary casting rope.

For the illustration (fig. 33), which shows one method of tying, I am indebted to Mr Joseph Donald, F.R.C.V.S., whose description[1] is thus summarised: An ordinary casting rope or good cart rope is used and doubled up so that one end shall be from 2 to 3 yards longer than its fellow on the opposite side. It is adjusted around the colt's neck as in the ordinary method of castration, the longer end being placed on the side upon which the colt is desired to fall. Throw in the usual way.

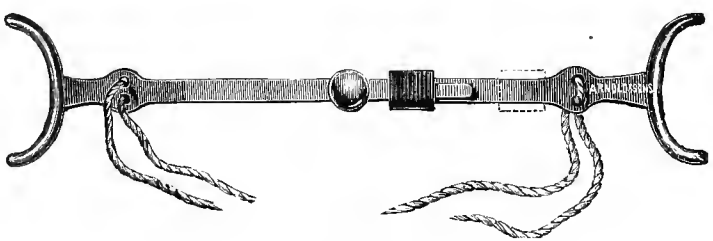


Fig. 34.—Spreader.

"When the horse is down the operator seizes the under rope, pulls it backwards under the withers, and winds it two or three times around the upper fetlock. He then passes it down in front of the upper stifle (A), backwards and under the quarters, bringing it up outside the opposite thigh (B), and round the front of the lower hind fetlock. The rope is next steadily and firmly pulled until the limbs are well flexed, then wound twice round the lower fetlock, passed down in front of stifle (C), over the quarters to the opposite side, and up inside the thigh (D). Now pull firm, wind twice round the upper fetlock, and give the rope (E) to an assistant to hold. The animal's feet are thus thoroughly and firmly secured to his own hind quarters.

"To secure each fore limb take a piece of light cord about a

[1] "Journal of Comparative Pathology and Therapeutics," Vol. I., page 334.

couple of yards long—a piece of good plough line answers well —double it round the fetlock, and pass the loose ends through the loop so formed, flex the knee, and pass one cord to the inside and the other to the outside under the fore arm, and tie on the upper side of the metacarpal bone, as shown in the illustration. The patient can then be placed in any convenient position as required by circumstances."

In exceptional cases a spreader is useful, this consisting of a piece of iron with a curved piece and loops of rope at each end; it is tied near the hock and keeps the legs apart. It can be improvised by an ordinary long twitch or broom handle with a loop of rope on each extremity, or by putting a

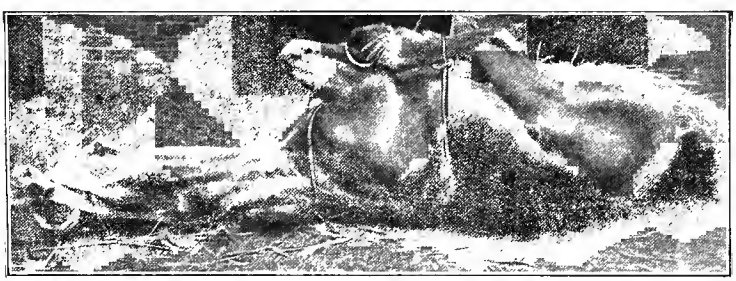


Fig. 35.—Showing "back" rope applied, and a "rig" colt secured in the dorsal position.

piece of rope or webbing just below the hock, passing it under the back, and tying it tightly to the hock on opposite side (*see* fig. 34).

Value and Choice of an Anæsthetic.—The cryptorchid operation in particular is one in which an anæsthetic should always be used, as the operator can rarely tell with absolute certainty what conditions he is going to meet with before making an incision and exploration. On humane grounds the use of an anæsthetic needs no defence, and on grounds of convenience to the operator and increased safety to the patient it is also to be preferred. It is very much easier to operate, and antiseptic measures can be more rigidly adopted when the patient is lying still than when struggling is continually taking place.

It is a precaution, too, of extra safety for the animal, as if the abdomen has to be entered the struggles are apt to eject a portion of omentum or intestine, whereas if an anæsthetic is used this is not nearly so liable to take place.

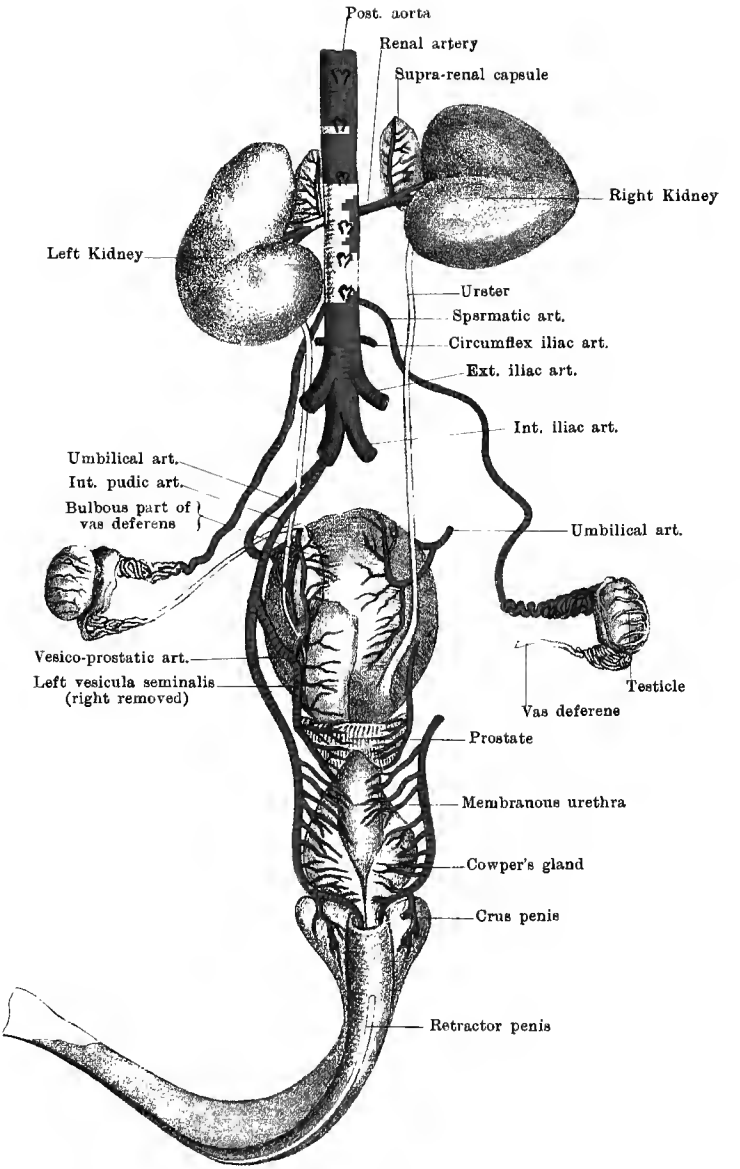
Chloral is sometimes used, from ½ to 1 oz. in mucilage being injected *per rectum* about an hour beforehand, or morphia (5 to 10 grains) may be given subcutaneously.

Cocaine, subcutaneously injected, answers well for the skin and parts involved when the testis happens to be superficially situated, but chloroform is undoubtedly the best for all general purposes. When the patient is under its influence the operator is prepared for all eventualities, and if the operation is difficult and the search prolonged he is not persistently flurried or annoyed by violent and frantic struggling.

Instruments Required; Preparation for Operation.— The instruments required are a sharp scalpel, a pair of dressing forceps, two or three pairs of Spencer Wells' artery forceps, a director, needle and silkworm gut or stout silk, and an écraseur[1] or emasculator. The latter is for the removal of the testicle, although, if preferred, and the length of the spermatic cord will permit it, this can be taken off by ligature, torsion or the clam and iron. The écraseur is, however, the most useful for all emergencies. A long, blunt seton needle is also of service to break through the abdominal wall, and also to rupture any cystic formation which may be too tough for the finger nail. For the same purpose the author has devised a small silver-plated tube from 1 to 2 inches in length, with the front edge sharpened, and having about 3 feet of rubber tubing attached. This, after being carefully sterilised, is introduced into the abdomen, and the cyst punctured, the fluid contents escaping down the tube to the outside of the body.

All instruments must be surgically clean, and to effect this should be sterilised by boiling immediately before use, or by placing for some time in a reliable antiseptic solution, and the operator should take care not to contaminate them during use.

[1] It is always wise to be provided with two chains in case of accident.



Drawn & Lithographed by W. & A.K. Johnston, Limited, Edinburgh & London.

GENITO-URINARY ORGANS OF MALE (CHAUVEAU)

Cotton wool, too, which is so much better than sponges for cleansing the wound, should previously be rendered sterile in the same way. If preferred, dry antiseptic or sterilised wadding or gauze may be used for swabbing up the blood.

The site of incision and surrounding parts should have all hair removed by scissors and razor, if necessary, and be painted with tincture of iodine (or iodised chloroform), which is allowed to dry on; or, if the operator prefers it, the parts can be thoroughly soaked and scrubbed with soap and hot water containing some antiseptic (such as creolin, carbolic acid, or chinosol), and carefully rinsed and scrubbed again with ether or ethereal soap and fresh solution of antiseptic. If possible an assistant should first do the dirtier parts. After this it should be wiped dry with sterilised wadding. The operator's hands and arms should be treated in exactly the same way, particular care being taken of the nails. It is wise to have two nail brushes, one being kept for the hands alone.

Surgical Anatomy.—In the inguinal region, after carefully cutting through the skin almost immediately over it, a little more forward than in the operation for ordinary castration, the operator will encounter a large plexus of veins. These are often of great volume, and must be carefully pushed aside, the hand and fingers (held wedge-shaped) boring their way by a rotatory movement through a quantity of loose connective tissue up the inguinal canal. This is easily found, and if there is no trace of testicle the fingers seek the upper inguinal ring, turn inwards to the abdominal wall, and penetrate it with the nail about an inch on this side. If the fingers cannot feel the missing organ the whole hand must be introduced. One is then in contact with a large mass of intestine, amongst which a careful search is made.

As rational guides it must be remembered that the abdominal testicle is denuded of its normal coverings, that it has at one end the spermatic artery, and at the other the epididymis and vas deferens. The spermatic arteries spring from the aorta just behind the kidneys, one on each side, and descend back-

wards towards the internal abdominal ring, being smoothly covered by parietal peritoneum during a considerable portion of their course.

The vas deferens, a long tube about two-thirds the thickness of an ordinary lead pencil, is a continuation of the epididymis, and finds its way to the side and neck of the bladder, where it dilates, forming what is known as the "bulbous" portion. The latter is an excellent guide to commence with, as from it

Fig. 36.—Showing site of incision, with an abdominal testicle ready for removal by the écraseur. The chain of the latter lies in the surgical wound.

the hand can make a start towards the testicle, following up the course of the vas deferens until the epididymis is reached.

Description of the Operation.—A shallow incision about 4 or 5 inches long is made through the skin almost directly above the inguinal canal, care being taken not to injure any of the large vessels which lie immediately underneath. These large veins are frequently much dilated, and have on more than one occasion been mistaken for testicle, and even cut into; injury to them is followed by profuse hæmorrhage, which is very difficult to stop, and may even be fatal.[1] The best method

[1] "Journal of Comparative Pathology and Therapeutics," December 1900.

of avoiding this is to prick the skin carefully with a scalpel, and complete the incision with the aid of a director. When once the skin is cut through, the tissues are pulled apart, and the remainder of the operation is done by the fingers, without again having recourse to the knife. Making sure again that the hand is thoroughly clean, the fingers are all put together in as small a space as possible in the shape of a wedge, and carefully rotated past the large veins into the inguinal canal. This is explored, and if the testicle is present it is grasped and withdrawn. Care must be taken not to unconsciously pass the testicle by or to remove an inguinal lymphatic by mistake. Sometimes the epididymis is in the canal and the remainder of the testicle in the abdomen,[1] and cannot be withdrawn without penetrating the wall of the latter. In such a case, if moderate traction is insufficient, the better plan is to enter the abdomen.

On the first occasion (July 1899) on which I met with this condition, thinking it to be an abnormally shaped testicle, I removed the epididymis only, finding it at the extreme top of the inguinal canal. The colt appeared quite cured of his troublesome habits for about six months, and then became as bad as ever. In the spring of 1901 the animal became quite unmanageable and dangerous, and a further operation was decided upon. On the 15th June the abdomen was entered and a full-sized, flabby testicle extracted. Recovery was uneventful, and the colt has since been perfectly tractable and quiet.

In this case[2] the patient, a lady's hunter, aged six years, had been tractable until the spring of 1899, when he became very vicious, using his fore feet freely, and being very troublesome to mount. From his savage behaviour towards other horses and the little history which could be obtained it was suspected that a retained testicle was at the bottom of the mischief. There was certain knowledge of the removal of the left testicle, but none of the right one.

On the 29th July 1899 the animal was cast and chloroformed, a small irregular-shaped body being surgically removed from the extreme upper portion of the right inguinal canal. The wound healed, and the horse became quieter in his habits for about two years. In the spring of 1901, however, he again manifested decided "rig" tendencies, and became as vicious and troublesome as ever.

Thinking that the curiously shaped piece of tissue which had been

[1] "Veterinary Record," Vol. XV., page 267. In one instance measured by the author the epididymis was 4 inches away from the body of the testicle.

[2] *Idem*, Vol. XV., page 190 (W. Bower and F. Hobday).

removed was not the complete testicle, the horse was again cast (30th September 1901) and chloroformed. An exploration of the inguinal canal gave a negative result. The abdomen was entered, and a full-sized testicle with the epididymis missing was extracted. Recovery was uninterrupted, and a complete cure of all his former bad habits resulted at once. Upon incising the testicle a very fine specimen of the strongylus armatus escaped from its interior, having been apparently about an inch below the surface.

The strongylus armatus (Professor M'Fadyean kindly verified the specimen) is not very uncommon in the scrotum of the colt on the exterior of the testis, but its presence in the interior has not often been recorded. The testicle of a "rig," when retained in the abdomen, has no external

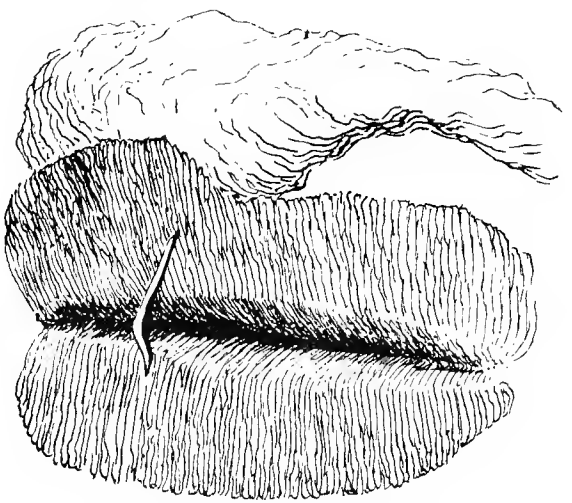


Fig. 37.—An abdominal testicle partly laid open to show a specimen of the strongylus armatus, *in situ*.

(From a sketch made at the time by Mr Santy, M.R.C.V.S.).

envelopes, and it was with surprise that we saw this worm emerge, as there was not the slightest indication of its presence discernible on the exterior.

Professor M'Fadyean also demonstrated the presence of spermatozoa.

If the testis is not in the canal the operator carefully passes his hand until the fingers almost reach the upper extremity, then, turning them inwards, the abdominal muscle is penetrated with the finger nail. Sufficient space is at first made to admit the fore and middle fingers, which search just inside for the missing testicle. It may sometimes be found in this situation.

If unsuccessful, the whole hand is introduced and another careful search made. Occasionally at this stage it comes into the hand quite unexpectedly.

If the testicle is not found at this juncture it is wise to commence a methodical search by seeking for some anatomical guide. The best of these are the spermatic artery and the vas deferens. When either of these is found it merely requires to trace it up to the distal extremity to find the testicle. The

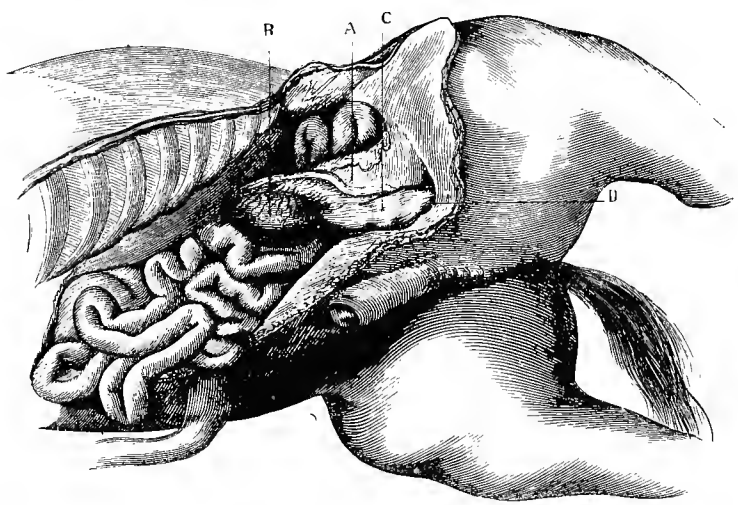


Fig. 38.—Position of the undescended testicle in the fœtus (Colin).

A. Fold of peritoneum by which the testicle is suspended from the lumbar region; B. Testicle; C. Gubernaculum testis; D. Inguinal ring.

vas deferens itself feels like a thick piece of soaked string, and the artery is known by its pulsation.

When found the testicle is recognised by its shape, by the epididymis affixed to it, by its flabbiness and smooth surface, and because it is by itself. Fæces in the intestine (which are the most likely to be confounded with it) are hard to the touch and multiple in number. If the patient is not deeply anæsthetised pressure upon it will cause struggling. Should any grave doubt exist, the organ ought to be slowly drawn into

view. When the search for an abdominal testicle is prolonged the operator may find that his hand and arm become cramped. Great relief from this can be obtained by plunging them into a bucket of cold water containing some disinfectant or in some way sterilised.

It can readily be understood upon reference to figs. 38, 39, and 40[1] that if certain abnormalities occur in connection with

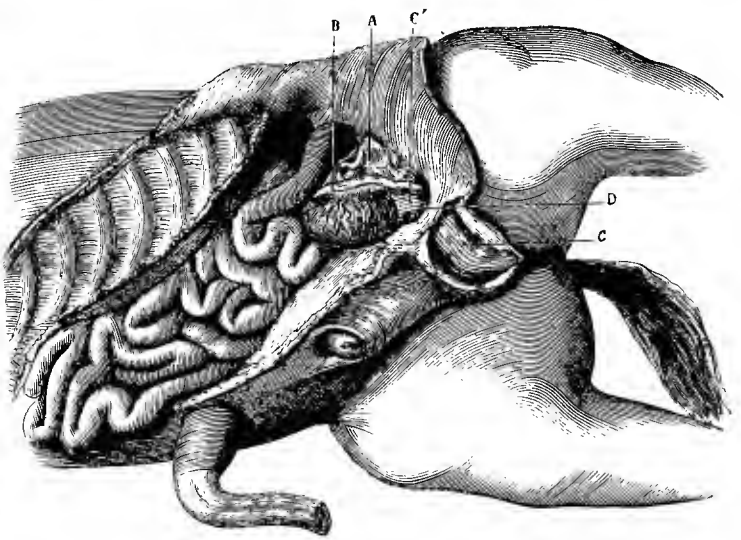


Fig. 39.—Showing the fœtal testicle drawn towards the inguinal ring (Colin).

A. Fold of peritoneum by which the testicle is suspended from the lumbar region; B. Testicle; C. Portion of the gubernaculum testis which has passed through the inguinal ring D.; C'. Internal portion of the gubernaculum folded on itself below the ring.

the peritoneal fold, with the testicle itself or its appendages (the epididymis, vas deferens, or spermatic cord), with the inguinal canal, the gubernaculum testis, or even the skin of the scrotum, a "rig" colt will probably be the result.

For example, the peritoneal attachment may be abnormally short or abnormally long at a certain period of fœtal or colt life. With the former the result might be that the testicle

[1] "Traité de Physiologie Comparée des Animaux," by Professor Colin.

would never descend from its position in the lumbar region but become a fixture, or it might descend a little way and thus not be able to reach the internal inguinal ring. If abnormally long it might not reach the internal inguinal ring at the time when this aperture would be sufficiently relaxed to admit of its passage, and it might not even reach it at all but be pushed out of place by some internal organ.

The testicle itself may be abnormally large, being cystic or

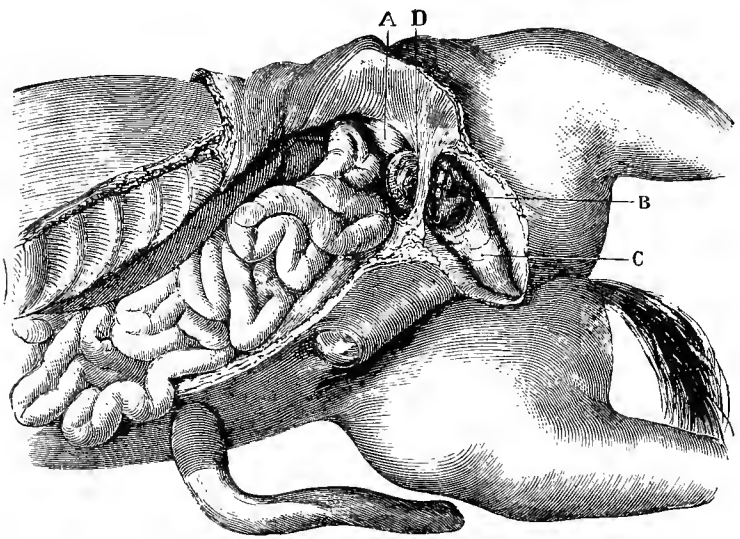


Fig. 40.—Showing testicle passing through the inguinal canal (Colin).
A. Fold of peritoneum by which the testicle is suspended from the lumbar region; B. Testicle; C. Gubernaculum testis; D. Inguinal ring.

otherwise diseased; the epididymis is frequently excessively large or misshapen. An unnaturally short vas deferens or spermatic artery, too, may cause retention.

The inguinal canal may be so narrow, or its entrance or external exit so small and abnormally contracted just at the period when the testicle approaches, that this latter organ cannot gain admittance, or, if admitted, cannot pass through into the scrotal sac.

The gubernaculum testis, by which the testicle is drawn

through the canal towards the scrotum, may be paralysed so that its natural function as a guide is useless; and, lastly, there may be some abnormal contraction of the skin of the scrotum by which, although the testicle has reached the external inguinal ring or even passed through it, the organ is either tightly held there or forced under the skin of the prepuce, abdomen, or thigh.

The operator should continually keep swabbing up any blood which may be present on his arm or at the entrance of the wound, and when once the testicle has been brought

Fig. 41.—Showing the contrast sometimes found between the visible testicle in the scrotum (10 oz.) and the hidden one in the abdomen (1 oz. 3 dr.).

into sight it may be removed by the écraseur or whatever instrument is preferred.

After the wound has been carefully cleansed (not swilled out, as this is likely to send blood up into the abdomen) and all blood clot removed, the skin wound should be closely sutured with boiled silk or silkworm gut if the abdomen has been entered, and the colt allowed to get up. If the abdomen has not been opened there is no need to suture, the case really being little more complicated than an ordinary castration. The colt should be allowed to get up with the side upon which the abdomen has been entered next to the ground, the weight of the body and upper hind leg thus lessening the tendency to

hernia of the intestine whilst the patient is recovering from the chloroform and struggling to rise.

On several occasions successful attempts have been made to castrate abdominal cryptorchids through the flank,[1] but this method is not advisable if it can be done through the inguinal

Fig. 42.—Abnormal shapes sometimes assumed by testicles retained in the abdomen.

region. The animal is cast and chloroformed, with the side uppermost from which the testicle is to be removed. The flank between the angle of the haunch and the last rib is shaved and disinfected as already described. An incision is made through the skin with scalpel and director, then through the muscle in

[1] "Veterinarian," February 1897 (G. E. King); "Veterinary Journal," May 1914 (E. C. Winter); July 1914 (E. Cargill Patrick).

the direction of its fibres, and finally through the peritoneum. The operator's hand is inserted and directed towards the pelvis, where a search is made for the missing organ. When found it is removed by the écraseur and the wound carefully sutured, the muscle and peritoneum separately with boiled silk and the skin with silkworm gut. This latter material, although it never becomes absorbed, is non-absorbent, and so leaves less likelihood of being the carrier of septic infection to the interior. The peritoneum may be sutured with the muscle, but the danger of hernia is lessened if it is done separately with fine boiled silk. Interrupted sutures, about a third or a quarter of an inch apart, are the best. The skin is then carefully dried and covered with iodoform and collodion (1-10), or orthoform and collodion (1-8).

Prognosis and After-Treatment.—Given the use of chloroform and strict attention to modern antiseptic principles, a most favourable prognosis may be given. It is astonishing how little swelling or disturbance (either local or constitutional) will ensue. A glance at the reports given of cases and the papers read on the subject will show that the proportion of deaths is very small,[1] especially if extraordinary abnormalities be left out of consideration.

The after-treatment consists in placing the patient in a clean loose-box, removing the two central sutures (if any have been inserted) about the third day, opening the wound a little to allow free drainage, and afterwards keeping it clean with antiseptics. The attendant should always wash his hands carefully before touching the parts. If there is no discharge the wound is better to be left alone altogether. Exercise should be given about half an hour or an hour night and morning, and the diet should be laxative.

In animals which have been brought from grass immediately before the operation the better plan is to turn them out again as soon as possible; in fact, if the testis is not in the abdomen

[1] "Journal of Comparative Pathology and Therapeutics," Vol. IV. (Donald); *Idem*, Vol. XI.; "Veterinary Record," Vol. XV., page 267 (Hobday); "Castration du Cheval Cryptorchid" (Cadiot).

but only in the canal, they are better turned back to pasture at once, the case really being only very little more serious than an ordinary castration.

Fig. 43.—Molar teeth (in various stages of development), removed from a dentigerous cyst taken from a cryptorchid's abdominal testicle by Mr Inglis. On the left is seen the curiously misshapen testicle itself. For this illustration and description I am indebted to Professors Williams and Taylor ("Veterinary Journal," 1901, page 25).

Abnormalities.—The cryptorchid operator must always be on the look out for abnormal conditions either of his patient or of the testicle and its situation.

The testicles may be found in almost any part of the abdomen, and have even been recorded close to the diaphragm. There may be an entire absence of one or both,[1] the animal may be hermaphrodite,[2] the testicle may be much enlarged and cystic, or hard and cirrhotic, degenerated (fig. 49),

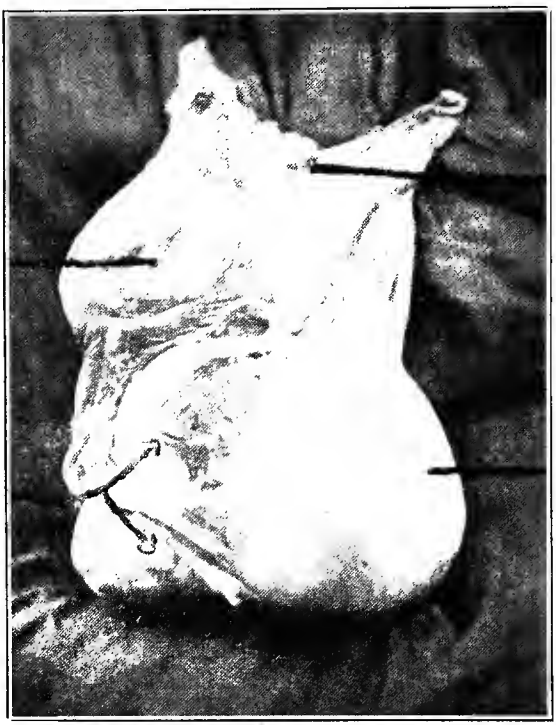


Fig. 44.—Dentigerous cyst of the testicle from two-years-old cryptorchid.[3]

adherent to the peritoneum or some abdominal organ, or contain such foreign bodies as worms,[4] hair, cartilage, osseous

[1] "Journal of Comparative Pathology and Therapeutics," Vol. XIII., pages 74 and 365.

[2] *Idem*, Vol. XII., page 336; "Veterinary Record," Vol. XV., page 247 (Dellaganna); "Veterinary Journal," May 1902 (Taylor and Rutherford).

[3] For illustration 44 I am indebted to Messrs H. Thompson and John Steel.

[4] See figs. 37 and 49.

or even tooth-like structure[1] (dentigerous cysts), and various kinds of tumour tissue.

Fig. 45.—Illustration of dermoid cyst in testicle. (For this photograph I am indebted to Professors Williams and Taylor.[2])

[1] "Veterinarian," Vol. LXVIII., page 371 (Dewar, Smith, and J. Peddie); "American Journal of Veterinary Medicine," March 1912 (Dr Gribble, Ohio State Veterinary Association Meeting).

[2] "Veterinary Journal," 1901, page 22 (Taylor and Forgham).

Dr Beecker, of Cologne, has reported one case in which the retained tumour was 79 cm. in length, 69 cm. broad, and the whole testicle weighed 100 lbs.[1]

In the dentigerous cyst depicted on a preceding page (fig. 43) the testicle was much larger than normal, being 6½ inches in length. There was gland tissue in the centre and a dermoid cyst at either extremity. In the anterior portion there were plates of bone and cartilage, and in the centre of the cavity there was a roundish mass, about the size of an orange, containing several teeth in various stages of development. The mass was fairly easily detached into nine pieces. One was almost a perfect molar tooth, being 2¾ inches long and grooved like an ordinary molar. At the end, which would correspond to the wearing surface in the ordinary condition, the infolding of the enamel was well shown. Six of the other pieces, one of which was bent upon itself, all bore more or less resemblance to molar teeth, the smallest being 1¼ inches in length. The three usual constituents —enamel, dentine, and cementum—entered into their composition.

The posterior extremity of the testicle contained a cyst having a wall chiefly composed of bone and cartilage. Inside this cavity were two smaller ones, one of which contained a coil of hair, black in colour and mixed with the *débris* usually found in these cases.

Cystic testicles have usually to be reduced in size before they can be withdrawn. This can generally be done with the finger nail, the contents escaping into the abdominal cavity; or a trocar or hollow needle with a long rubber tube attached may be used. A case of Degive's contained 10 ozs., and Hickes has reported one containing 39 fluid ozs.[2] Dewar and Anderson have reported a case[3] in which a cystic testicle (intra-abdominal) removed from a two-years-old horse weighed 3 lbs. 2 ozs., and when emptied only 5 ozs. 1 dr. It measured over 18 inches in diameter one way and over 16 inches the other.

Dermoid cysts are not uncommon.

In the one illustrated (fig. 45) it was found that, when incised, five separate cavities were present, four of which contained hair. Some of the latter were loose and some fixed. In colour the hairs were black, brown, and grey, and some of them measured 7 inches in length.[4] In the centre of the whole mass there was an irregular bony plate, and the rest of the dermoid appeared to be of fibrous tissue.

[1] "Berliner Tierärtz Wochenschrift."
[2] "Veterinary Record," 11th November 1905.
[3] "Veterinarian," Vol. XVIII., page 371; Vol. XXXVI., page 155.
"Lancet," 24th February 1906, page 847.

Of the various kinds of tumour tissue met with the author has had experience of sarcoma, embryoma, fibroma, and lipoma, the microscopical examination being made by experts in each case.

The lipoma was exceptionally interesting on account of its rarity, the following being an account of the case.[1]

The patient, a valuable Welsh shooting pony, four years old, had been purchased out of a drove, and was supposed to have been castrated. No evidence of testicles could be felt, and it was not until the animal had been in the owner's possession for some months that his "rig" propensities developed themselves. Perfectly quiet and tractable at his work, he was troublesome when turned out and when in the proximity of other horses.

On 10th October 1905 the patient was cast and chloroformed; no scar could be perceived, and a search up each inguinal canal revealed them to be empty. The testicles in each case were readily discovered in the abdomen, and removed without difficulty, strict attention being paid to asepsis. Sutures were applied in the usual way, but when the pony got up a swelling was distinct on each side of the scrotum. Thinking this to be bowel the animal was cast and chloroformed a second time, the prolapsed gut was returned, and the inguinal canal sutured very deeply, the sutures being placed close together. The patient was then allowed to rise, and was placed in a narrow stall, with the hind quarters raised, and kept standing up, being sparingly fed, for three weeks. For a week the wound remained clean and apparently free from suppuration; then it suppurated a little, but without giving rise to any inconvenient symptoms, and eventually the patient made an excellent recovery. The sutures were not removed, but were allowed to slough out, and in about three weeks the patient was taken to exercise.

The specimen was examined by Dr Shattock, Pathologist to the Westminster Hospital and Curator of the Royal College of Surgeons' Museum, and was found to be a lipoma. One half of the specimen has now been placed in this Museum, and its rarity may be imagined when, on the authority of Dr Shattock, we are assured that a *lipoma* of the testicle has never before been recorded (to his knowledge) either in men or animals.

The following three cases,[2] which were met with during 1912, are illustrative of some of the abnormalities met with by the "rig" operator. For the pathological examination and descriptions I am indebted to Sir John Bland-Sutton, F.R.C.S.

Fig. 46 was a cystic embryoma removed from a Shire colt three years old. The left testicle was in the scrotum, and weighed 10½ ozs., the right one being in the abdomen and weighing 1 lb. 9 ozs.

It was much enlarged and contained cystic fluid with several pieces of cartilage and bone.

1 "Veterinary Journal," March 1906 (Gooch and Hobday).

2 *Idem*, March 1913 (Hobday).

The pathological description is as follows :—

This is a specimen of unusual interest ; it is as large as a cocoa-nut. On dividing it in a sagittal direction the bulk of the tumour consists of a large cavity filled with fluid, and on its floor there is a lobulated solid tumour the size of a duck's egg enclosed in a thin osseous capsule. The epididymis is easily seen. A small body (A) lying on the wall of the cyst

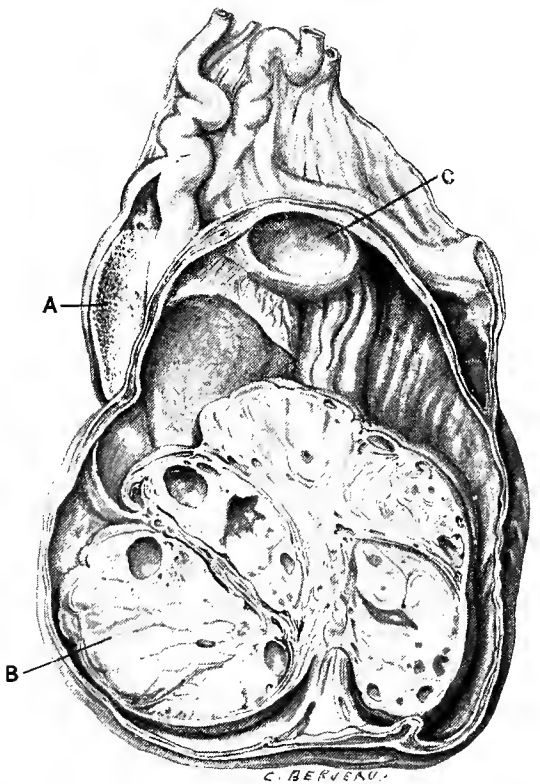


Fig. 46.—Embryoma of the testicle. A, True testicular tissue ; B, Tumour tissue ; C, Cyst.

represents the body of the testis, and on microscopic examination seminiferous tubules are easily seen.

The tumour is an embryoma contained in a cyst and replacing the paradidymis. The solid bone-encapsuled body contained within the cyst is made up of embryonic tissue containing secreting glands, tracts of bone, and cartilage.

A cystic testicular embryoma of this nature is a rarity.

Fig. 47 was removed from a Shire colt thirteen months old. The left

testicle was in the inguinal canal and the right one in the abdomen. It weighed 2½ lbs. after the fluid was removed. This latter process was done by scratching the cystic portion through with the finger nail whilst in the abdomen, as it was too large to be removed, unless an enormous wound had been made, before this was done.

The pathological description is as follows :—

In the drawing the testicle is represented in sagittal section. The body of the testis is as big as a turkey's egg, and contains three cysts filled with

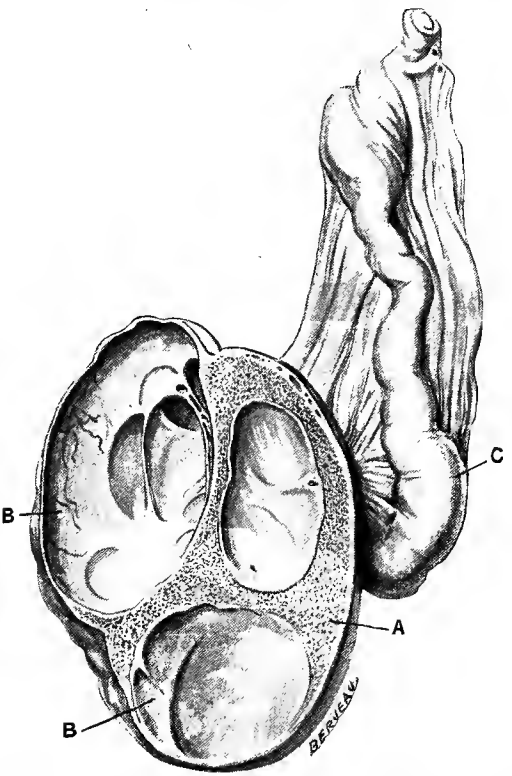


Fig. 47.—Cystic testicle. A, Testicular tissue ; B, B, Cysts ; C, Epididymis.

yellow fluid. The cysts are separated from each other by narrow strands of tissue containing seminiferous tubules. The cysts are lined with dense fibrous tissue devoid of epithelium.

Cystic disease of the body of the testis, as seen in this specimen, is not uncommon in rams.

It has nothing in common with the condition known as general cystic disease of the testis in man, for in the latter the disease arises in the paradidymis, between the body of the testis and epididymis, and though

the secreting tissue of the testicle is compressed by the tumour the cysts never invade it.

Fig. 48 was a bay Shire colt, two years old. The right testicle was in the abdomen and weighed 1½ lbs.

The pathological description is as follows :—

This testicle is about the size of a duck's egg, and the relation of the various parts is represented from a sagittal section of the organ. The

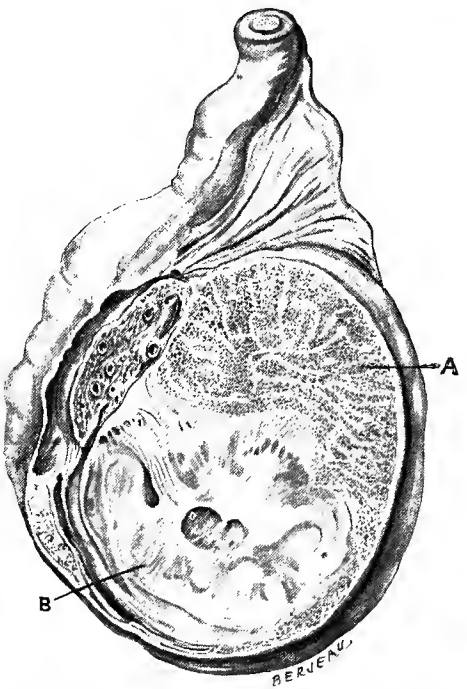


Fig. 48.—Cystic embryoma of the testicle. A, Tumour tissue with body of the testicle on the left ; B, Cyst cavity.

testis and epididymis are widely separated from each other by a mass of tissue having the naked-eye features of fat. This block of tissue compresses the proper tissue of the testis which lies flattened around the periphery of the fat-like mass which replaces the paradidymis. Microscopically the tumour contains the mixed elements of an embryoma. The tissue itself is embryonic in character, and collections of glandular tissue resembling the secreting glands of the skin are fairly abundant. Neither hairs nor teeth were detected in the sections.

Each of the horses made a good recovery, and there were no complications to cause anxiety. The operations were done under chloroform, and

in each instance the only method of preparation was to paint the skin with tincture of iodine, no soap and water being used at all.

The case from which fig. 47 was obtained was clinically interesting as illustrating that the fluid contents were aseptic, as a considerable quantity escaped directly into the abdominal cavity. This, however, has been observed before both by myself and by other writers.

In cases where the testicle is of enormous size, as an alternative to making a large wound in the abdominal wall, Cadiot[1] and Degive suggest that the cord shall be pulled into the inguinal canal and cut through, a portion of it being removed, the enlarged testicle thus being allowed to drop free into the abdominal cavity.

The worm which sometimes finds its resting-place in the surrounding envelopes of the testicle, and sometimes even in

Fig. 49.[2]—Showing a front view, split open, of a degenerated cyst-like body (actual size) removed from the end of the spermatic cord. The cord was attached behind. In the lower portion is to be seen a small mass of the sebaceous-like contents. At the side is a sketch of the worm (strongylus armatus) taken from the interior.

the testicle itself, is the **strongylus armatus**.[3] Mr J. B. Gresswell has recorded a number of these parasites in a cavity in the centre of an abnormal testicle, this organ being for the most part indurated and weighing 4 lbs. 3 ozs.

The patient (fig. 49) was a well-bred hackney colt, from the right side of whose scrotum a well-developed testicle had been removed about three months previously. The animal was troublesome with the mares. On the left side there was no sign of testicle, and exploration of the inguinal canal revealed this to be empty. The colt was bred by its present owner. Under

[1] "Castration du Cheval Cryptorchid."

[2] "Journal of Comparative Pathology and Therapeutics," Vol. XIII., page 366.

[3] *Idem;* "Veterinary Journal," Vol. XXII., page 87 (J. B. Gresswell); "Veterinary Record," Vol. XV., page 190 (Bower and Hobday).

chloroform a careful search was made in the abdomen for the missing organ, and at last a degenerated cyst-like body about the size of a walnut, with attachments like those of a normal testicle, only much less fully developed, was withdrawn. As the undeveloped cord was too short to permit of its complete withdrawal, I removed it by scraping with the finger nail and then using traction. An incision made into this revealed the contents to consist of thick creamy-white material of the consistency of sebaceous matter or inspissated pus, and, in addition, there came out a small whitish-coloured worm about as thick as an ordinary wax match and nearly an inch in length. After a renewed search, as nothing further in the shape of a testicle could be found, the wound was sutured in the usual way and the patient allowed to get up.

The horse appeared to progress in every way favourably until the ninth day afterwards, when the left hind legs became very much swollen. During the day the animal fell down and was unable to rise Death took place at night.

At the *post-mortem* examination, which was made by Mr G. D. Martin, M.R.C.V.S., Mr Martin Sparrow, V.S., and myself, we found that the body I had removed was undoubtedly the degenerated remains of the testicle, as the thin, poorly-developed cord could be discerned with the severed end clearly shown. There was no trace of peritonitis, and death appeared to have been due to septicæmia, as the muscles of the inside of the thigh were in a fœtid condition.

Professor M'Fadyean confirmed the diagnosis of the degenerated specimen, and also examined the worm, which proved to be a strongylus armatus.

In the human subject living **acari** (histiogaster spermaticus) have been found.[1]

In one particular instance the patient was a doctor, and it was estimated, after careful microscopical examination and calculation, that there were over 800 living acari in the contents of a cyst in the right testicle. "To account for their presence in the cyst Dr Trouessart (of Paris) suggests that an egg bearing female was adhering to the catheter which the patient had passed in India (some years before), that she attached herself to the urethral mucous membrane, entered one of the ejaculatory ducts, and followed the vas deferens till she reached the epididymis, where she probably commenced to lay her eggs, the infarct thus produced causing the rupture of the mucous membrane and the formation of the cyst."[2]

Adhesions between the testicle and peritoneum must be broken down with the fingers.

Lastly, one must not forget the curious shapes assumed by some testes (*see* fig. 42). They are often, when in the inguinal

[1] "Quarterly Medical Journal," August 1902 (Pye Smith); "Archives de Parasitologie," No. 3, 1902 (Dr Trouessart).

[2] "Lancet," 23rd August 1902.

canal or abdomen, no larger than a walnut, even in big horses (*see* fig. 41), and at times the epididymis may be alone in the canal and the remainder of the testicle in the abdomen.[1]

Untoward Sequelæ.—Of course one must not overlook the liability to accidents, such as **fractures,** and those which may happen during any operation which involves casting or the use of chloroform. Other untoward events likely to happen are those of hæmorrhage from injury to some of the large inguinal veins, descent of the bowel, or death from shock and exhaustion if the animal is kept on the ground too long.

Amongst subsequent unfavourable results are those of colic, descent of omentum or bowel (hernia), peritonitis, septicæmia, tetanus, excessive swelling, the formation of an abscess, and paraphimosis.

If the testicle is not found after half an hour's search it is a good plan to critically examine the condition of the patient before proceeding further. It may be necessary to remove all restraint and resort to the careful use of stimulants, such as strong ammonia or amyl nitrite, to the nostrils, and ether or other stimulants, subcutaneously or *per rectum*, if the patient is unable to swallow.

In regard to **Hernia,** as a rule, if the bowel does not come down at the time or within an hour or two afterwards, there will be sufficient swelling of the lacerated tissues to prevent this mishap, although Ostermann has recorded a case[2] in which it came down on the tenth day afterwards. In this instance it was returned, and, with the exception of an inguinal swelling, the patient made a good recovery. It is always a serious sequel, and the only remedy consists in casting and chloroforming the horse again as speedily as possible, carefully washing the protruding portion with antiseptic, and then returning it. Sutures should be inserted as deeply as possible, and not more than a quarter of an inch apart. A plug of sterilised wadding or tow materially assists in some cases in

[1] "Veterinary Record," Vol. XV., page 190 (Bower and Hobday).

[2] "Journal of Comparative Pathology and Therapeutics," Vol. II., page 117.

keeping the bowel in, being pushed well up the inguinal canal before the skin wound is stitched. Some of the sutures are cautiously withdrawn either on the second or third day afterwards, the plug removed, and, after careful cleansing of the wound, replaced with a fresh one. The dressings are now changed two or three times a day and the parts kept as antiseptic as possible.

Frohner has recorded[1] an instance in which a patient, operated upon six days previously through the left inguinal canal, showed symptoms of strangulated hernia. The swelling was as large as a child's head and the patient much distressed. Successful reduction was effected, and the horse did well.

Descent of the Omentum alone is not so serious. The protruding portion may be excised, and the remainder replaced into the abdomen, sutures being inserted as in cases of descent of the bowel.

Colic during the first twenty-four or forty-eight hours is not uncommon. Probably it is due to a small piece of bowel having temporarily descended into the inguinal wound, or it may be caused by soreness of the parts which have necessarily been injured during the operation. It is not usually a cause for alarm, and generally passes off without treatment. If anything is necessary, either an opiate or full dose of cannabis indica can be given.

Peritonitis, that bugbear of old-fashioned surgery, may occur from septic infection either at the time of operating or afterwards. The former has nowadays, thanks to the application of modern antiseptic principles, become comparatively rare, and, to avoid the latter, the operator must see that the loose-box, or place in which the patient is to be placed, has been cleansed and disinfected and otherwise made warm and suitable. In regard to the after-dressings (where such are needed), the person who applies them should do so with clean hands, and the dressings themselves must be kept in a clean place. When there is a lot of pus in the castration wound it must

[1] Bulletin Vétérinaire, January 1900 ("Monatshefte für Thierheilk.")

be removed as thoroughly as possible, because the organisms seem to have an exceptional faculty for reaching the peritoneum through the medium of the injured cord in the inguinal canal. Antiseptics should be used very freely. If the interior of the abdominal wall has become infected the patient may die within three or four days, or may linger for three or four weeks. Recovery is possible, but the prognosis must be very guarded. Antiseptics, opiates, and stimulants may be given internally at the discretion of the practitioner, and hot blankets applied to the abdominal wall.

Septicæmia, if the wound is not kept clean, may cause death in about a week or ten days, especially if during the operation the muscles of the thigh have become lacerated so as to form little sinuses in which pus could lodge and burrow if the wound became infected.

Excessive swelling afterwards will cause the colt to be very stiff in gait, and show signs of inconvenience and pain. As a rule, exercise and antiseptic attention to the wounds will be followed by relief in three or four days, although the application of hot or cold water may be necessary. The chief precaution in these cases is to keep the wounds well opened and as clean as possible.

If an **Abscess** forms it should be lanced and thoroughly drained, the interior being irrigated with antiseptics.

In connection with this sequel, as also with those of peritonitis and septicæmia, it is worth while to recollect that after a retained testicle operation it is by no means uncommon when the colt rises to hear air rush into the wound. If the operating bed is made of some dusty material, or the air is otherwise contaminated, this may prove a source of infection. Personally I prefer a grass field to operate in when it is at hand, or, failing that, a clean wheat straw bed.

Paraphimosis, a condition in which the penis becomes protruded and the horse cannot withdraw it into the prepuce, is sometimes caused by excessive swelling of the tissues surrounding the wounds. It is more likely to occur after a

prolonged operation upon both sides of the scrotum than when only one side has been opened. It may become very troublesome to treat, and convalescence may be prolonged. It may even terminate in paralysis of the organ.

In the patient whose unfortunate sequel is illustrated in fig. 50 nothing could be seen or felt by external manipulation, and no history was obtainable as to the side from which a testicle had been removed; in

Fig. 50.—Paraphimosis (five weeks after operation).[1]

fact, it was not even known that one had been taken away. Exploration was first made on the right side, and as no remnant of cord was detected the abdomen was entered. After half an hour's futile search the other side was explored with similar result. In all, the hand was in the abdomen about an hour and a quarter. Suddenly, after a withdrawal for a few moments' rest, and immediately after a struggle on the part of the patient, the testicle appeared at the wound on the left side. Whether it had come from the abdomen, or whether it had been in the

[1] For this photograph I am indebted to Mr J. F. Talbot, M.R.C.V.S.

canal the whole time and I had inadvertently passed it by, I am not prepared to say for certain. The cord was abnormally thin, but the testicle was of fair size. Recovery from the operation itself was quite uneventful, except for the fact that paraphimosis ensued as a sequel, and the penis never became normal.

Treatment consists in careful scarification of the protruding part, to which either hot or cold water (depending upon circumstances) is afterwards applied, and the use of some astringent lotion, such as a mixture of lead acetate and zinc sulphate (℥ii-℥vi of each to a quart of water), or lead and alum, etc. The penis should be supported by a sling, which can be improvised from two or three stable bandages or a piece of netting and two bandages, the ends being tied over the patient's loins. The horse should be put under the best possible hygienic conditions, fed well and exercised regularly, and internally should be given some nerve tonic, such as arsenic, strychnine or nux vomica.

Prognosis of this condition should be guarded, especially if the organ has been protruding for some days before the practitioner's attention has been drawn to it, as occasionally one meets with a case in which permanent paralysis ensues. An animal with a long protruding penis is apt to be objected to for road work, although it can be worked in the fields, where it will be comparatively free from observation. If the objection is very marked, and no improvement ensues after a prolonged period of regular treatment, the only remaining resource is to amputate the offending portion.

Influence of Age and Time of Year.—As a rule one is not asked to operate before the colt is two years old, because up to that age there is always the chance that the testes, if low down in the canal, may descend into the scrotum.

In operating upon a yearling, especially if the animal is not very well developed or is out of condition, there is always more risk of subsequent descent of the bowel if the abdomen has to be entered. The tissues are not so strong as in animals of more mature age. The actual season of the year does not make the slightest difference to the success or otherwise of

the operation provided the patient can be placed under good hygienic conditions afterwards.[1]

Concluding Remarks.—In many cryptorchid cases the history obtainable is very scanty and uncertain, so that now and again the "rig" operator will find that his patient has already been castrated, and that the real cause of the trouble is an enlarged epididymis. In the words of the farmer, he has been **"cut proud."** The removal of this will cure the sexual propensity, but of course such a case could hardly be termed a true "rig." One must not forget, too, that the swelling noticed by the owner may be a scirrhous cord. Unless the animal has shown decidedly troublesome or vicious propensities, or the owner is absolutely sure that castration has never been done, the operator should be cautious in regard to his method of procedure. The mere presence of a scar on the scrotum might mean that an unsuccessful attempt at castration has been made, or it might mean that the wound has been inflicted with fraudulent intention, the object being to deceive the intending purchaser. Exploration of each inguinal canal will go a long way towards solving the difficulty, as, if the testis has ever been in the scrotum since the days the animal was a foal, and has been removed, the end of the spermatic cord will be felt as a lump or a long, thin body varying in lumen from that of a piece of string to the piece of an ordinary casting rope. If nothing is to be discovered subcutaneously or in either canal, and the history is that of a "rig," the probability is that there is a testicle in the abdominal cavity. Rectal exploration is sometimes of assistance, the fingers being turned downwards towards the inguinal region, whilst an assistant pushes his fingers as far up the inguinal canal as possible from the exterior. Either the cord or a testicle may be felt upon manipulation. This can, in a quiet horse, be done when standing, but, of course, when cast and secured the facilities are greater. To examine the inguinal

[1] This conclusion is drawn from experience of more than 400 cryptorchid operations performed in all seasons and at every time of year.

canal from the exterior the hand is held flat and pressed, with the fingers closed, between the thigh and the abdominal wall. If the operator has had his hand and arm in the rectum this should be thoroughly scrubbed and disinfected, and the other hand used for the search; also for anything connected with the wound if the operation is performed on that day. It is safer to postpone the operation. *To ensure success the strictest care in regard to antiseptics and surgical cleanliness is as essential to our patients as to those of our human confrères.*

In regard to the **differences in size and weight** of abdominal testicles as compared with those in the scrotum there is no fixed rule, as can readily be seen by reading the various notes in small type. In numerous instances the testes were measured and weighed, and as a general rule the presence of a very large testicle in the scrotum meant a smaller one in the abdomen or inguinal canal, but where cysts or tumour tissue were present the abdominal testicle would be much the largest and heaviest.

There seems, too, to be a common impression that as a general rule if one testicle is present and one absent, the missing one is more likely to be the one from the right side, and the left one is the one in the scrotum. Statistics, however, taken from over 400 consecutive cases, appear to show that the numbers run about equal, and that the right is as often in the scrotum and the left in the abdomen as *vice versâ*.

CHAPTER IV.

CRYPTORCHIDISM IN OTHER ANIMALS.

MISPLACED testicles are met with by the veterinarian in other animals besides the horse, although in them he is not so frequently called upon to operate; as if the beast is one which can be used for food it is fattened up, and its short life ends in this way before it attains sexual maturity. Expense debars operative interference, and it would be unwise to use the animal for stud purposes on account of the risk of hereditary tendency.

THE BULL.

In the bull it is not at all uncommon to find one or both testicles subcutaneously placed in the groin or well forward in front of the inguinal canal, and occasionally one meets with them in the abdomen. They are usually smaller than normal, but one does not meet with the same proportion of abnormalities in shape or contents as one finds in the horse.

If an operation is desired the subcutaneous testes are generally able to be removed without trouble, the beast being cast and secured in the usual way. When the testes are inside the abdomen the operator reaches them through an incision in the right flank, just below the angle of the haunch, in a similar situation to that for the operation for "gut-tie."

If done when the animal is standing the "bull-dogs" are placed on the nostrils and cocaine is injected subcutaneously at the site of incision. Under antiseptic precautions the incision is then made in a downward and slightly diagonal direction through the skin only, that through the muscles following, as far as possible, the direction of their fibres. The hand is then

Fig. 51.—Photograph showing area of incision.[1]

inserted in a backward direction, and the testes sought for, each being removed in turn by the écraseur.

If the animal is cast the same procedure is adopted, or chloroform may, if preferred, be used as the anæsthetic. The chief precaution to be remembered is to be quite sure that the beast has been rigidly starved beforehand for a minimum period of twenty-four hours.

[1] "Veterinary Journal," September 1912 (Messrs Grasby and Reynolds).

THE RAM.

For the description of the operation in the ram I am indebted to Mr T. Inglis, M.R.C.V.S., of Forfar, who has castrated a great many of these animals, and has very kindly sent me the photographs here shown. The testicles may be subcutaneously placed in an abnormal position or they may be abdominal.

Fig. 52 shows the method of securing the ram, with its right

Fig. 52.—Showing the method of securing a ram for operation.

flank uppermost, before operation, an assistant sitting on the beast in the manner depicted, and holding the fore and hind legs respectively together firmly gripped around the shank bones. A portion of wool is then removed, and the skin painted with iodine or otherwise rendered antiseptic, an incision being made high up in the flank in front of the angle of the haunch and behind the ribs, the wound being sufficiently large to admit

Fig. 53.—Site of the wound with the testicle withdrawn before being removed.

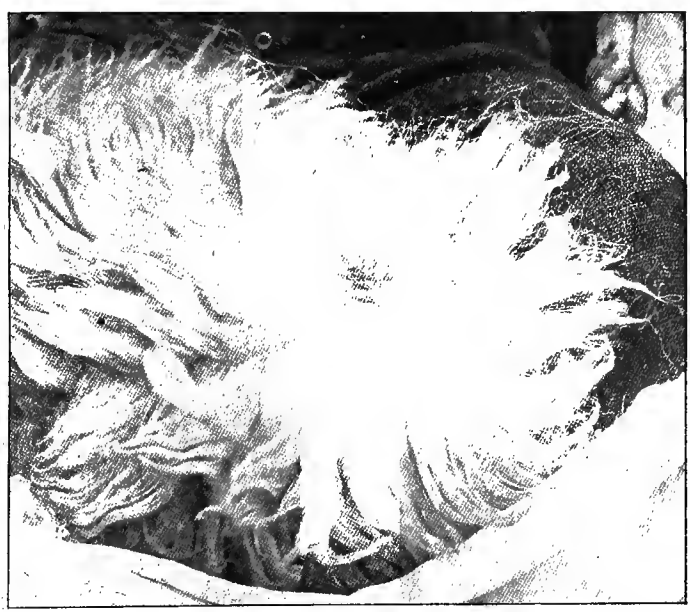


Fig. 54.—Method of securing the wool after the wound has been sutured and dressed.

the hand of the operator. A search is then made for the lost testicle, and when found it is drawn outside and taken off

Fig. 55.—Showing the exact position of the incision and the appearance at the completion of the operation. This animal was a "double" rig.

Fig. 56.—Photograph illustrating the difference in size between the scrotal and abdominal testicles.

with the écraseur. The other, if abdominal too, is removed in the same way, from the one wound if possible, instead of having to open either side. The wound is sutured and dressed

in the usual manner, and a few portions of long wool from either side drawn together, and tied with silk in such a way that the wound is covered completely over. The animal is then allowed to get up, and kept on restricted diet for about a week or ten days until the edges have firmly united.

The percentage of fatalities is very small.

THE PIG.

In the pig malplacement of one or both testes is common, and it is by no means a rare occurrence to get both in the abdomen.

Subcutaneously placed in the groin or under surface of the flank they are easily accessible, and if in the abdomen they are removed through an incision high up in the left flank, being extracted by the introduction of the second and third fingers only. In a large boar it would be necessary to use the écraseur or the clam and iron, but in the young pig they are merely cut or scraped off with the knife, and the edges of the wound are drawn together with silk suture.

Antiseptics are very rarely used, and the operation is usually done by a country gelder, whose knife is very rarely washed or sterilised, the pig afterwards running off to join its fellows in their customary unclean surroundings. Occasionally a fatality occurs from septicæmia or tetanus, but such an occurrence is rare.

An expert will generally perform the operation, even when the testes are in the abdomen, from start to finish within two minutes, and on numerous occasions I have personally made observations upon those who "**spay**" the female pig[1] (an almost identical operation), and have seen the whole thing done in the almost incredible space of thirty-two seconds from the moment the incision was made through the flank until the sutures were inserted and tied.

It is not usual, in little pigs at all events, to use any anæsthetic, the patient for the abdominal section being held by the

[1] *See* p. 152.

operator stooping over the beast and placing his right foot on the pig's neck, holding the left hind leg slightly raised in his left hand (the pig lying on its left side squealing vigorously) whilst with his right hand he deftly operates.

For a malplaced testicle in the groin or externally visible an attendant holds the pig up by the hind legs with its body tightly between his knees, and the operator stands in front in the position most convenient to himself.

THE DOG.

In the dog cryptorchidism is not infrequently a source of dispute in the law courts, as on more than one occasion a vendor has been accused of having castrated a puppy before sale when in reality the animal has been a double abdominal cryptorchid. On four separate occasions it has been the author's lot to be called in to settle such insinuations on the part of the purchaser, the result of the operation in each case being to return the castrated dogs and the perfect testicles removed from the abdominal cavity to the disputing parties.

A cryptorchid dog, like a cryptorchid horse, is a continual nuisance to its owner, as it is usually amorous, and is not so apt to pay discriminative observation as to the sex of its companions, whilst as age creeps on it is apt to become bad-tempered and treacherous. Castration is the only remedy.

The operation is performed as follows: Under the influence of morphia or chloroform the abdomen is shaved at the median line just in front of the prepuce, and painted with iodine or otherwise treated antiseptically. An incision is made from 1 to 2 inches long with a scalpel and director through the skin and peritoneum, and the forefinger or middle finger inserted in a backward direction towards the pelvis. As a rule the testicles are readily found floating at the end of the spermatic cords in the pelvic region, and are easily withdrawn to the exterior, one at a time, where they are removed either by scraping or after the use of a ligature. The abdominal wall

is then sutured in two layers,—the peritoneum with "ten-day" catgut and the skin with silkworm gut.

After-treatment consists in dieting the dog sparingly for about a week, and in painting the wound twice a day with

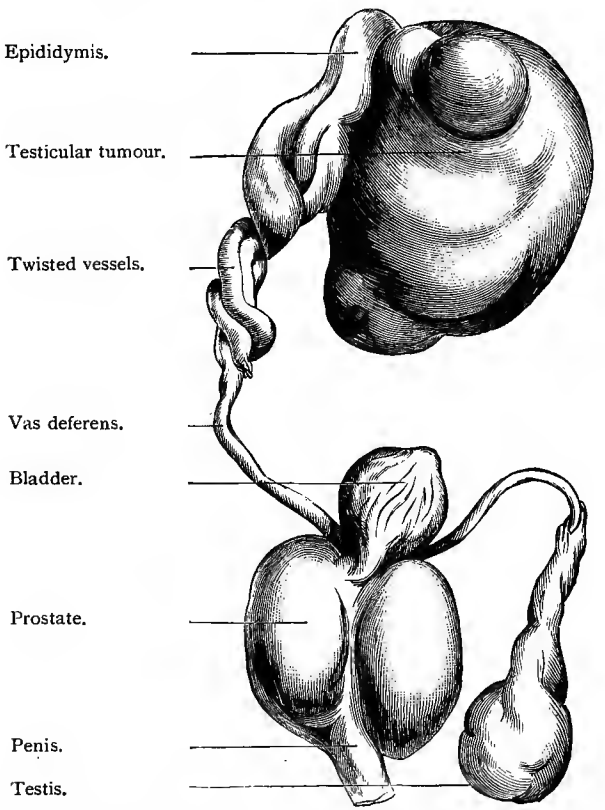


Fig. 57.—Torsion of the cord in a cryptorchid dog's testicle (Sir J. Bland-Sutton).[1]

iodine, the skin sutures being removed in about six or eight days, when the wound will have healed *per primam.*

With testicles malplaced in the groin or subcutaneously under the skin of the abdomen the method of procedure is the same as that for ordinary castration.

Malplaced testicles in the dog are often the subjects of

[1] "Surgical Diseases of the Ovaries" (Second Edition).

tumour growth, which generally prove upon examination microscopically to be sarcoma or carcinoma.

THE CAT.

The town practitioner frequently gets his attention drawn to this condition in the cat on account of the fact that if both testicles are not removed from this animal the urine has a peculiar and unpleasant odour, and even if only one testicle is left, whether it is in the abdomen or in any other part, this characteristic smell of the urine persists. Such an animal, especially if of unclean habits, becomes unendurable, and it rests with the owner to decide between an operation or the lethal chamber.

If the question of fee does not stand in the way all this unpleasantness can be removed by surgical interference, the primary incision being made either in the median line or the left flank under the usual antiseptic measures. For healing purposes of the wound afterwards the flank incision is preferable, and the higher it is made the better, as the crouching attitude assumed by a cat kept in a cage afterwards rather tends to allow the omentum or intestine to remain in contact with the incision if made on the abdominal floor, and to cause adhesion to take place afterwards; whereas when the incision is made high up in the flank the intestines fall away from this.

Experience has taught that the cat appears more comfortable, and in fact usually pursues a perfectly normal course in regard to feeding and general habits, the wound healing *per primam*, and the sutures being removed on the fifth or sixth day.[1]

Experience has taught that before a final and definite opinion is given that the missing testicle *is* in the abdomen, a *very* careful search should be made in the skin of the groin and abdomen, as on account of the presence and length

[1] "Veterinary Journal," 1912 (Hobday).

of the fur (especially in the Persian breed) a small body like a testicle can readily be missed.

It is awkward to explain afterwards to an anxious owner why the abdomen was opened if the testicle is eventually found upon second and more thorough search to have been all the time hidden away in the groin! and the author has had experience of two such instances.

CHAPTER V.

THE CAPONING OF DOMESTICATED FOWLS.

THE removal of the generative organs from fowls has long been practised, but not to such an extent in the British Isles as on the Continent. In France, in particular, it has become a source of regular employment to certain people, and in some districts women have become very expert in the operation. In England the "Surrey capon" is well known to epicures as a great delicacy, and from 7s. 6d. to 10s. 6d. is quite a common price

Fig. 57A.—Cockerel fixed on the table with spreader *in situ*.[1]

in the London market, as compared with from 3s. 6d. to 4s. 6d. for an ordinary young cockerel.

The objects of the operation are to increase the size of the bird and the delicate flavour of the flesh for table purposes, and, secondly, to prevent the young cockerels from fighting with one another, as the removal of the testicles diminishes their combativeness.

According to Leeney,[2] who has operated upon many thousands of birds, the best months of the year for the operation are August, September and November, "when cockerels are cheap and unruly, and will fight amongst themselves and worry the pullets." When castrated they can be allowed in any company. Quoting from Mr Leeney's article: "They are no longer combative but usually found together, and as much despised by the females of the flock as eunuchs are by the ladies of the harem. They are disposed to sit about when not seeking food, and this of course favours growth and

[1] For this photograph I am indebted to Mr W. C. Hazelton, M.R.C.V.S.

[2] "Veterinary Journal," December 1913 (Harold Leeney, M.R.C.V.S.).

development of certain parts. The muscles used in combat are not among them, for the head and neck takes on an effeminate appearance, but the rump expands, and the poulterer knows in a moment whether a fine grown cockerel or a capon is offered him."

The Method of Operation.—It is essential that the birds should be well fasted. A period of thirty hours is desirable, as by that time the intestine is more or less collapsed as well as empty, and a view of the testicle can be obtained when it is desired to remove it. The subject is stretched upon a table after the manner one extends a sow pig for spaying. In the absence of help one may suspend a bottle of water[1] from the butts of the wings, and another from the legs, in order to secure the subject. Then the few small

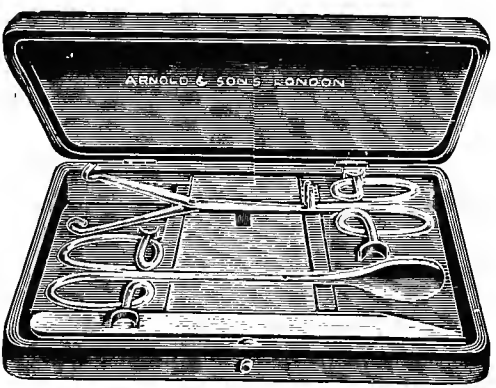


Fig. 58.—Caponing instruments (Farmer Miles' pattern) for domesticated fowls.

feathers between the last two ribs and the point of the hip may be plucked, and the operating site exposed. This is between the last two ribs. With a clean incision the skin and intercostal muscles are divided. As with castrating animals, a bold sweep of the knife causes less hæmorrhage than a feeble, funky pricking at the tissues; and there is no risk of puncturing the bowel if the fasting period has been observed. If the incision is made high enough up there will be found a "V" shaped opening in the peritoneum, and under this the surgeon introduces his scalpel with cutting edge upwards, and divides the

[1] Two halves of a brick are often utilised for the same purpose, or the bird can be fixed with hobbles on an ordinary canine operating table.

membrane for the full length of the wound. This gives a view of the testicle when the spreader or gridiron instrument has kept the ribs apart.[1] Then one has only to introduce the spoon-shaped forceps and seize the organ in order to bring it out. It is well for beginners to squeeze the testicle out of its investments, rather than to break the vessels by throwing the hand aside, as one does when confident and with a large number to get through in a given time. Hæmorrhage is thus avoided. The bird is then turned over, and the same process gone through in order to reach the other gland. It is much less trouble and more safe to operate on both sides than to seek both organs from the one side. The bird is then liberated, and will generally try to recoup himself by swallowing the missing testes if some soft food has not been provided in anticipation. The appetite is not in abeyance, and the subject takes no notice of such a trifling incident in his career.

After-Treatment and Sequelæ.—Nothing should be done to the wound.[2] It quickly seals with a clot. The only trouble experienced is emphysema of the flank in a few cases. The remedy is to prick the skin and let the air out. The bird is not inconvenienced in any way if this is not done.

If a bird is going wrong it will be immediately. The rupture of a great vessel is followed by tumbling head over heels like one whose neck has been broken. He may be washed out with vinegar and hung up in the larder to be eaten like any other fowl.

The caponer will not of course choose the Mediterranean types for making big capon, but go for "Plymouth Rocks" and first crosses of Indian game and Dorking, or the now popular Sussex fowls. It may be mentioned that "fine Surrey fowls," which are always quoted at the top of the market, come very largely from Sussex, and chiefly from the district known as "the Dicker," where caponing has been carried on by two or three famous families of veterinary surgeons for generations.

[1] It is a good plan to operate in full daylight with sun behind so that the interior of the bird is illuminated. An electric torch answers very well.

[2] Some operators prefer to suture, ordinary surgical silk or thread being used, and the sutures being left to come out by themselves.

Pullets are occasionally done, the ovarium being removed through a flank incision as in the male.

The operation has also been performed upon **ducks, geese** and **swans,** but the custom is not such a common one as in the domesticated fowl.[1] Seligman and Shattock have shown[2] that the effect of castration on the drake done whilst the bird is in full plumage delays its passage into "eclipse."

THE CAPONING OF OSTRICHES.

This operation, which has been brought to perfection in South Africa mainly by the perseverance and careful skill of Mr Stanley Elley, M.R.C.V.S., is now largely practised in Cape Colony, the Transvaal, and other districts where ostriches are reared.

It is done with equal success upon the female as well as the male bird, and it is interesting to note the change of colour, and consequent increased value of the feathers, in the spayed hen as compared with the one whose ovarium remains intact. The objects of the operation and the method of operating cannot, however, be better described than in the words of Mr Elley himself, as quoted from an illustrated article written for the *Veterinary Journal* in August 1913 :—

The objects which it was sought to obtain by the operation were as follows—

(1) To check the indiscriminate breeding of inferior birds, which was at that time being largely practised, particularly in the Midland and North-Western Districts of the Cape Province, then the Cape Colony.

(2) To enhance the value of the feathers (*a*) by the production of cleaner and less damaged feathers, (*b*) by increased weight.

(3) To tame vicious birds.

(4) To produce good foster-parents, which, whilst looking well after the chicks, would not become savage when fed along with the chicks on grain.

Moreover, it seemed most probable that if it proved possible

[1] A teratoma $15 \times 11\frac{1}{2} \times 7\frac{1}{2}$ cm. has been reported in connection with the left testicle of a black Wyandotte cock. It contained cysts and feathers. "Journal of Comparative Pathology and Therapeutics," June 1911 (Sheather and Sparrow).

[2] "Proceedings of the Zoological Society," March 1914.

to castrate birds with but a slight percentage of deaths from the operation the practice was bound to become general, since with no other class of stock would all the entire animals produced be allowed to remain as such.

It may now, after only seven years, be claimed that the anticipations then expressed have in every instance, though in varying degree, been realised. Indiscriminate breeding is

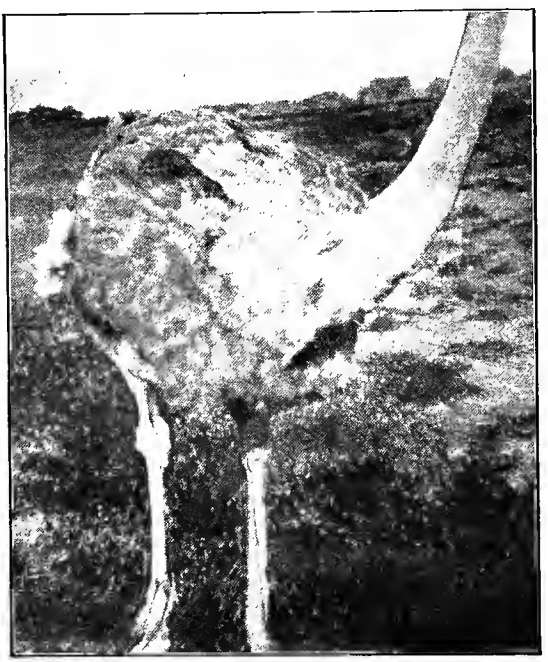


Fig. 59.—Spayed hen. Note black feathers. Hen six months after castration. Observe the drab feathers, both on the upper part of wing and chest, commencing to turn black.

rapidly decreasing, and although this is by no means due entirely to castration, there is no doubt that the practice gave a stimulus to the breeding and classing of the superior birds, particularly in the districts above referred to.

That the feathers of capons are cleaner and less damaged than in the entire birds no one will dispute, while some farmers who kept careful records state that the weight of the white

feathers alone increased as much as an ounce per bird per plucking after castration.

That all vice has been permanently removed from even the most savage and dangerous birds when castrated is well known

Fig. 60.—Bird ready to be cast. Showing how the attachment is placed round the legs. Ordinary plucking cap on the head.

practically on every farm where the operation has been performed, these having generally been the first birds selected for the operation. Again, those farmers who use capons as foster-parents would almost as soon lose one of their valuable breeding birds as one of their "Kuiken-Wachters."

The fact that seven years ago the operation was practically

unknown, whilst to-day there are several men throughout the Province who make a living by this one operation alone is sufficient indication that the practice is becoming popular. Not only, as has been stated, has the weight of the feathers been increased, but no corresponding falling off in gloss or lustre, as was predicted by those opposed to the operation, has been testified to by the largest feather buyers in Africa.

The extraordinary phenomena of the feathers of the castrated

Fig. 61.—Bird cast and receiving the anæsthetic.

hens assuming the characteristics of the male birds' feathers has enhanced the value of such feathers even more than was contemplated.

The Operation.—The bird having been starved for from twelve to twenty hours is cast in the following manner: An ordinary plucking cap is placed on the head, and a "riem" (a long rawhide strap with a ring attached to one end) or a soft rope is quickly placed round the legs in the figure-of-eight fashion, commencing with the left leg, the side on which the

bird must fall; one man takes hold of the left wing and a second of the tail, whilst the third takes the free end of the riem and pulls steadily, standing at a right angle to the bird's right wing. As the legs are pulled from under the bird those holding the wing and tail allow the bird to come steadily to the ground on its left side, which position is maintained throughout the operation. The plucking cap is now removed and the chloroform inhaler takes its place. A drachm to two drachms of pure chloroform are placed within the inhaler, this dose being repeated every two minutes until complete anæsthesia is

Fig. 62.—The site of the operation. Note position of legs.

produced. This usually occupies six to eight minutes, depending to some extent upon the size and condition of the bird and the weather, strong winds causing an excess of air to enter the inhaler. The eyes being covered by the inhaler the conjunctival reflex cannot be taken. A simple method to ascertain if the patient is completely under the influence of the anæsthetic is to take hold of the right leg, lying uppermost, and attempt to pull the bird on to his back. This will invariably be resisted, even when a sharp slap fails to bring any response. The legs can

now be entirely loosened, or otherwise each one must be held in a separate riem, so that the right one may be taken forward as far as possible, which arrangement exposes the seat of the operation.

At the junction of the skin of the leg with that of the body a small pouch or cul-de-sac will be seen in the loose skin; this pouch is the spot from which the incision commences. Having well disinfected this area, an incision about 4 inches long is made through the skin, cutting backwards and very slightly downwards. The amount of subcutaneous tissue encountered between the skin and peritoneum will depend upon whether the birds have been grazing upon the veldt or upon lucerne lands. In the former case only a very slight layer of the abdominal muscles, less than a quarter of an inch in thickness, will separate the skin from the peritoneum, whereas in the lucerne-fed bird it is not uncommon to find an inch or more of adipose tissue covering the peritoneum. Having reached this membrane care must be taken not to injure the underlying gut when opening into the peritoneal cavity. Either the peritoneum may be grasped in the forceps and raised from the underlying structures, or otherwise a very slight opening may be made with the knife and the point of the finger inserted, when it may be readily raised and the opening enlarged to admit the hand, which is now lubricated and forced gently inwards in an upward and slightly forward direction, when the testicles will be located immediately between the hip joints attached firmly along the dorsal surface on either side of the spinal column, a fold of mesentery separating them from each other.

In a bird which has not yet reached the breeding stage, that is, under about eighteen months, the testes are encountered as two firm elongated structures about the thickness of an ordinary lead pencil and about 1½ inches long. It is at this age that it is advisable to operate. After a bird has reached maturity and has once paired, it is impossible to say in what condition the testes may be found, for, unlike any other animal or bird with which the writer is acquainted, the reproductive organs, and

more particularly the testicles of the ostrich, enlarge during the breeding season, or whenever food is abundant, to an almost incredible size, again rapidly diminishing under adverse conditions. The largest testicles removed from an old breeding bird by the writer measured 7 inches long by 3 inches in diameter, weighing together 2 lbs. 2 ozs. Any condition between this and that described in the immature bird may be met with. The firm, characteristic feel of the testicles is, however, unmistakable, nor are there any other organs in this vicinity with which they could be confounded, the kidneys being large, flattened, hand-shaped structures, deeply embedded in the lumbar region. Having located them, the left or lower one should first be removed. An opening is made through the mesentery and the testicle grasped in the hand; it will be found to be attached along its dorsal surface, and this attachment is broken down with the point of the fingers, beginning at the posterior extremity. The tissues, except in an old bird, will be found to break away readily until the anterior extremity is almost reached. At this point the various vessels enter and leave the organ, which should now be twisted until the connection is severed. The right or upper gland is then similarly removed. In cases where the testes are not developed to any great size, the one first removed may easily be retained in the palm of the hand whilst the second is removed, thus necessitating but one entrance and withdrawal of the hand from the peritoneal cavity. On the other hand, where the testes are very much enlarged considerable difficulty may be experienced in removing them from the abdominal cavity. In these cases the operator brings the detached organ to the opening with the right hand, and passes a curved suture needle threaded with quarter-of-an-inch tape through it with the left hand; it is then allowed to fall back into the abdominal cavity, the hand is withdrawn, and the testicle removed by means of the tape. In cases where the testes are enlarged and vascular and considerable hæmorrhage has taken place, the abdominal cavity should be swabbed out with a few pieces of boracic lint or cotton-wool

before suturing the incision. It then only remains to suture the peritoneum with five or six gut sutures, depending upon the size of the incision made, and the skin and muscle layer taken together with the same number of eighth-of-an-inch tape sutures, and the operation is complete.

The Female.—The hen is cast in a similar manner to the male bird, the site of the operation being identical. It will, of

Fig. 63.—The operation completed.

course, be remembered that only the right ovary is developed in birds. It is found in precisely the corresponding position on the right-hand side as the left testicle of the male, and it is, therefore, necessary to break through the fold of the omentum before it can be removed. The position and attachment of the stomach preclude the possibility of operating from the left side, which otherwise would be the most convenient in the hen bird. In the female it is only young birds of less than two years of

age which should be operated upon. In those that have reached the breeding stage the ovary and many of the eggs contained therein have attained such a stage of development that ovariotomy is impracticable. In hens under the age stated the ovary to the touch gives one the impression of a small bunch of small grapes, and consists of hundreds of unfertilised eggs varying in size from a pin point to a small marble, all developing from a common membrane. This membrane is attached precisely as the left testicle, and is removed similarly, the

Fig. 64.—After the operation. The inhaler removed and the bird placed in its natural position.

forefinger being inserted under its most posterior extremity and gradually worked forward, when it will be found to readily strip away. Care must, however, be taken to remove it in its entirety, otherwise some degree of egg development may recommence. Having removed the ovary the remainder of the operation is as in the male.

Before removing the chloroform inhaler the patient must be placed in the position natural to birds when lying, that is, on the chest, with the legs pulled out well on either side to prevent

it falling on its side. The bird should then be left without anyone, and if possible without other birds in sight, in which case when it wakes up it will probably remain lying quietly until the effects of the chloroform have passed off, when it will get up of its own accord. Should there be other birds close to the place, or should it be frightened upon waking up, in attempting to rise hurriedly it may fall heavily, tearing out the stitches and causing rupture through the incision. This point should always be borne in mind and insisted upon, as with the exception of a few deaths from careless administration of chloroform on an occasion when 500 birds had to be operated upon in a limited time, the only fatalities encountered have occurred when the birds were too hastily caused to rise while still semi-conscious, and, after floundering about, fell and caused rupture.

The after-treatment consists merely in keeping the birds short of food for the first few days, after which the regular grazing may be allowed. There is no need to remove any of the stitches. The internal ones are quickly absorbed, and the outer tape sutures will be attended to by the bird himself, although I have occasionally found them in position as long as twelve months after the operation, apparently causing no irritation.

It may have been observed that no great stress has been laid upon asepsis, which is customary when treating upon intra-peritoneal operations. This is not due to an oversight, for, although strict cleanliness is always practised, the fact is that such a thing as peritonitis or septicæmia in any form is unknown in the ostrich. This is no doubt accounted for by the different composition of the blood to that of mammalians. In close upon 2000 castrations, many of which have been in the nature of demonstrations where large numbers of farmers have placed their hand within the peritoneal cavity to locate the testicles, no single case of peritonitis or other septic conditions have been known to result, and owners have now come to look upon the bird as safe when once he has risen to his feet after the operation.

CHAPTER VI.

OBSERVATIONS UPON THE EFFECTS OF CASTRATION IN ANIMALS.[1]

Observation B 1.[2]

A. Two cocks of the same brood and of the same strain (Ardennes) were selected.

B. Two cocks of the same brood and of the same strain (Italian) were selected.

One animal in each pair was castrated, the other kept entire. They are distinguished as A. Capon, A. Cock, and B. Capon, B. Cock.

Before the operation was performed the weights of the animals were—

A. Cock	980 grammes.
A. Capon . .	845 „
B. Cock	785 „
B. Capon . .	805 „

The age of all the animals was three months and twelve days.

Eight months after operation the animals were killed, when their weights were—

A. Cock .	1955 grammes.
A. Capon . .	2800 „
B. Cock .	2105 „
B. Capon . .	2650 „

[1] Abstracted from a paper on Abnormal Bone Growth in the Absence of Functioning Testicles by Professor A. C. Geddes, M.D. (Professor of Anatomy at the Royal College of Surgeons in Ireland), in the "Proceedings of the Royal Society of Edinburgh," Vol. XXXI., Session 1910-11.

[2] "De l'Influence de la Castration sur le Developpement du Squellette (Pirsche, E.). Thère de Lyon, 1902, A. Storck et Cie.

On examination the bodies of the capons were found to be much fatter than those of the cocks.

Examination of the Skeleton.

The bones of the capons were longer, thicker, and denser than those of the cocks. The actual measurements of the long bones and the percentage increase of the bones of the capons are shown in Table XXXI.

TABLE XXXI.

	A. Cock.	A. Capon.	Percentage Increase.	B. Cock.	B. Capon.	Percentage Increase.
Femur .	9	9·8	9	7·4	8·3	12%
Tibia .	13·4	15·1	12·6	12·2	13·2	8·2%

In all these birds the epiphysis and diaphysis had joined, but Selheim[1] has shown that in the capon there is delay in the completion of the process of endochondral ossification.

Observation B 2.[2]

The Effect of Castration upon Guinea-pigs.

Three guinea-pigs of the same litter, age forty-five days, were taken. One was left entire, two were castrated.

The weight of the animals was—

No. 1, castrated .	325 grammes.
No. 2, castrated	400 ,,
No. 3, entire .	355 ,,

After the operation the three animals were placed in one cage, and were treated absolutely alike. They were weighed regularly, and an interesting series of observations was recorded. At first the castrated animals got rapidly heavier. No. 1,

[1] Selheim, H.: "Kastration und Knochenwachstum," Hegars Beitr. zur Geburtsh. und Gynäk., Bd. ii., 1899.

[2] "Etudies Biologiques sur les Géouts" Launois, P. E. & Roy, Pierre. (Paris, 1904, Masson et Cie.)

castrated, which to start with weighed 30 grammes less than No. 3, entire, surpassed him in weight, and at the end of four months was the heavier by 150 grammes.

No. 1, castrated	770 grammes.
No. 3, entire . .	625 ,,

For the next four months the weight of these animals remained stationary, at the end of which time they were killed.

No. 2, castrated, which to start with weighed 45 grammes more than No. 3, entire, gained weight up to three months, at which time he weighed 655 grammes. No. 3, entire, at the same time weighed 595 grammes. From the third month on the weight of No. 2, castrated, did not materially alter until the end of the eighth month, when he was killed. As stated above, No. 3, entire, increased in weight to a total of 625 grammes.

No. 2, castrated .	655 grammes.
No. 3, entire .	625 ,,

In each of the castrated animals the penis remained undeveloped.

On examination of the bodies, naked-eye, there was no marked increase in the amount of fat in the castrated animals,

TABLE XXXII.

	Control.		No. 1, Castrated.				No 2, Castrated.			
	Length.		R.		L.		R.		L.	
	R.	L.	Length.	Increase per cent.	Length.	Increase per cent.	Length.	Increase per cent.	Length.	Increase per cent.
Femur	44	44	46½	5·6	47	6·8	47½	7·9	47	6·8
Tibia	46½	46½	49½	6·4	50	7·5	50½	8·6	50¼	8
Humerus	38	38	39	2·6	39	2·6	40¾	7	41	9
Ulna	42	42¼	44	4·7	43	1·7	43	2	43	1·7

in spite of their slightly greater weight. The bones of the skeletons were somewhat bigger than those of the entire male, being not only longer but thicker.

The measurements of the long bones of the limbs and their percentage increase, as compared with those of the control, are given in Table XXXII.

The paws of the castrated animals were exceedingly large. This enlargement was so striking that it suggested acromegaly, and the pituitaries were examined with negative results.

Ossification was complete in the control; none of the epiphysial cartilages of the castrated animals had disappeared.

Observation B 3.[1]

Poncet carried out experiments upon dogs and upon bitches.

A litter of five pups—two dogs and three bitches—was taken. One dog and two bitches were castrated, the remaining dog and bitch being kept as controls. Some months later the five animals were killed and their bones examined. The measurements and percentage increases in the dog are given in Table XXXIII., in the bitches in Table XXXIV.

TABLE XXXIII.

Name of Bone.	Length in mm. of Bone of		Percentage of Excess of Length.
	A, Control.	B, Castrated Animal.	
Femur .	14	17	21·4
Tibia . .	50	56	12

TABLE XXXIV.

Name of Bone.	Length in mm. of Bone of			Average Percentage of Excess of Length.
	A, Control.	B, Castrated Bitch No. 1.	C, Castrated Bitch No. 2	
Femur . .	15	15·5	15·5	3·3
Tibia . . .	50	54	54	8

[1] Poncet: Congrès de l'Association Francaise pour l'Avoncement des Sciences. (Havre, 1877.)

Another observation upon the effects of castration upon the skeletons of dogs is recorded by Brian.[1] He compared the weight of the skeletons of castrated animals with the weight of the skeletons of controls, with result shown in Table XXXV.

TABLE XXXV.

Comparison of the Weight of the Skeleton of Castrated Animals with the Weight of the Skeleton of Controls.

Average weight of skeleton of castrated animals	240 grammes.
Average weight of skeleton of control animals	175 „
Percentage of excess of weight	18·7

Summary of the Observations. Group B, 1-3.

In animals which have been castrated there is—

1. An increase in the length and weight of the bones.

This increase tends to affect especially the more distal segments of the limb. Exceptionally it affects the proximal segment more than the distal. This occurred in the hind limb of one capon and one castrated dog, and in three fore limbs of two castrated guinea-pigs. In each of the two exceptional hind limbs the absolute growth was greater in the more distal segment. In the case of the three guinea-pig fore limbs the absolute growth was less in the more distal segment.

2. There is a delay in the obliteration of the epiphysial cartilages.

The second of these results is important, and it is desirable to emphasise it. As a result of observations[2], [3], [4] in the slaughter-house it has been found that a bull's epiphyses have joined the bone shafts by the time the animal is two years old, whereas in the bullock the process of endochondral ossification is not completed until the animal is three or even four years old.

[1] "Gazette hebdomadaire de Médicine et Chirurgerie" (Brian). Août, 1901.

[2] Bonnet, quoted by Launois and Roy, *op. cit.*, p. 87.

[3] Ueber das Knochensystem eines Castraten (Becker, Dr Ph. F.), "Archiv. für Anatomie und Physiologie." Anatomische Abteilung, 1899.

[4] Koudelka: Das Verhältnis der Ossa longa zur Skelethöhe bei den Säugethieren, "Verhandl. des naturf. Vereins. Brünn," 1885, Bd. xxiv.

These facts show that the disturbance in the proportions of the limbs, and the undue prolongation of the process of ossification which takes place in the absence of functioning sexual glands, may fairly be ascribed to the metabolic effects of an uncomplicated testicular failure.

The Physiological Meaning of the Ascertained Facts with Regard to Castrated Men and Animals.

As a result of the anatomical and anthropological survey undertaken of this paper it was found that—

1. The effect of castration is to stimulate and to prolong the period of endochondral ossification.

2. This stimulation and prolongation tends to be especially marked in the more distal segments of the limbs.

These generalisations can now be replaced by the statements—

1. The effect of castration is to determine a markedly anabolic type of nutrition which increases the liability of the cartilage cells to death by surfeit.

2. The cells forming the more distal segments of the limbs possess in the majority of cases a greater absorptive power than those forming the more proximal, and consequently experience the greatest liability to death by surfeit.

It is well to examine in detail the collateral evidence in support of the first of these statements. If it be established, the second, in the light of the definitely ascertained anatomical facts, is inevitably true.

Scattered through the records of the experiments upon castrated animals there is evidence of the favourable type of their somatic nutrition.

Thus, in the experiment upon fowls (Observation B 1) the capons were found to be very fat, and weighed 2800 and 2650 grammes, compared with weights of 1955 and 2105 grammes attained by the cocks used as controls. But indeed, with regard to capons, it is unnecessary to go to the laboratory for such collateral evidence, for it is because of this very fact that

castration does determine a greater body growth that poultry breeders capon their cockerels. A rather instructive point in this connection is that many of the so-called capons sold by poultry dealers are in reality young cocks and hens subjected to forced feeding with the aid of cramming machines.

Similar evidence exists with regard to other castrated animals, and this condition of what may be called hyperanabolism persists for some time, but as the animals age it passes off. The reason for this is not difficult to understand, but its demonstration would involve a long digression. It is merely mentioned here to point out that it is not to be expected that old castrated animals will be heavier than old entire animals.

Summary and Conclusions.

(*a*) The immediate effects of the removal of functioning sexual glands are hypothesised as twofold :—

1. The demands upon the internal food-supply of the body are lessened.

2. The body is deprived of some internal secretion or nervous stimulus.

(*b*) The mediate effects are certainly twofold :—

1. The cells of the epiphysial cartilages are stimulated more rapidly to proliferate.

2. There is an arrest in the development of the penis, the scrotum, the prostate, the antrum of Highmore, and possibly the brain.

(*c*) There is no evidence to show why the arrest in the growth of these parts takes place. It may be supposed to be due to the absence of a stimulus to growth conveyed by an internal secretion or through the nervous system. However it be effected, it appears to differ in origin altogether from the stimulus to growth experienced by the epiphysial cartilages.

(*d*) The normal mode of death of the cartilage cells in the process of endochondral ossification is by hypertrophy and surfeit. Increased rate of growth of the epiphysial cartilages is due to an increased rate of death by surfeit of the cartilage

cells. This increased rate of surfeit is preceded by an increased rate of proliferation.

(*e*) Since the composition of the arterial blood is uniform, departures from the normal inter-relations of the amount of growth can only be due to differences in the absorptive power of the cells of the different epiphysial cartilages.

(*f*) When the sexual glands are removed or destroyed there are departures from the normal inter-relations of the amount and rate of growth of the cartilages.

(*g*) These departures are not fortuitous, but follow the same regular plan in men and animals.

(*h*) So long as all the epiphysial cartilages are open, the stimulus to growth affects most markedly the forearm and leg, less markedly the femur and humerus, and, at first, still less markedly the limb girdles and the vertebral column.

(*i*) In cases of later onset of the state of anorchidism, and at a late stage in cases of early onset, the relative excess in length of the leg and forearm is less, whereas the pelvis is both relatively and absolutely larger.

(*k*) In cases of late onset of the state of anorchidism, *i.e.*, onset after the closure of all the epiphyses, there is no change in the proportions of the skeleton.

(*l*) In man intermediate between the late, skeletally unaffected anorchids and the eunuchoids there is a type in which the body form is almost the reverse of the eunuchoid type. The forearm and leg are relatively short, the femur and humerus of slightly increased size, the pelvis wide from side to side but shallow from front to back, the scapula broad, and the vertebral column, more especially the thoracic segment, long.

(*m*) In cases of early testicular failure the duration of the period of endochondral ossification is prolonged, it may be for years.

(*n*) The bones of anorchids are smooth and graceful.

(*o*) The skin of anorchids is glabrous, except in cases of post-pubertial onset.

(*p*) In many, if not in all, cases of anorchidism in man the skin is freckled and pigmented.

CHAPTER VII.

OVARIOTOMY AND HYSTERECTOMY.

Introduction.—By the term **oöphorectomy** is meant the removal of the healthy ovaries, and the word "**ovariotomy**" is used in the same sense when these organs are diseased. The commoner application, by which either is better understood in country districts, is that of "**spaying.**" To "**spay**" an animal means to remove its ovaries, and the operation is practised on all the domesticated animals, especially the sow, the bitch and the cat.

By the term "**hysterectomy**" is meant the excision of the uterus, and by "**ovaro-hysterectomy**" the complete excision of the two, whilst by the term "**hysterotomy**" (more commonly spoken of as "**Cæsarean section**") is meant that an incision is made into the uterus, this being done as a general rule when the uterus is pregnant, and with the object of removing the fœtus or fœtuses.

In animals it is the more usual practice to remove the ovaries alone, or the uterus and ovaries together, as to leave the ovaries and remove the uterus alone would still leave the animal with sexual desire, and make the beast as big a nuisance as ever.

In the smaller animals the ovaries are removed through an incision in the flank or *linea alba*, and the flank method of operation used to be followed out for the mare and cow. Now, however, thanks to the researches of Charlier and Colin, removal through the vagina has completely taken its place. This method is cleaner, more surgical, and safer in every way.

THE OVARIOTOMY OF TROUBLESOME MARES.

In the mare it is by no means uncommon to get a condition of almost constant œstrum, during which period she will behave most indecently, squealing, stretching her hind legs apart and passing urine in short, sharp, jerky streams at frequent intervals. She may even become vicious and lash out or stamp her feet furiously. When put into harness she may lie against the shaft, or merely become out of condition, stubborn and listless. If anything touches the hind quarters she will kick and squeal. In some mares this state of affairs persists during œstrum; in others it occurs between the periods, the animal being quieter when "in season." In either case the animal is objectionable to its owner, and professional aid is usually called in. Medicinal sedatives, such as the bromides of potassium, sodium or strontium, may answer temporarily, and even tide over a year or two, but eventually there comes a time when the mare is too treacherous or too objectionable to use, and she must either be sold or something further be done. It is at this stage that surgical aid can often intervene with success, and the operation of ovariotomy be performed. If a diseased condition of the ovaries is the cause of the trouble (and this is the case in by far the greater proportion), their removal will nearly always effect a cure if done soon enough. The **failures** are usually to be found in aged mares, or those to whom kicking has become a confirmed habit on account of its long standing.[1] If the operation is done before the habit has existed for any great length of time, the results are excellent,[2] and for mares which have become a nuisance on account only of indecent behaviour the operator can almost always give a prognosis of cure.[3]

Removal of the healthy ovaries (oöphorectomy) is sometimes

[1] "Proceedings of the Lancashire Veterinary Medical Association," 7th December 1899; "Veterinary Record," Vol. XII., page 359.

[2] This opinion is based upon the results of more than ninety consecutive cases in which the author has performed the operation.

[3] "Journal of Comparative Pathology and Therapeutics," Vol. XV., page 155; "Veterinary Record," Vol. XIII., page 229.

practised in racing mares in order that when put into training they can be relied upon to keep in better condition during the summer, and not to stay alongside another horse during the race. They are also said to be more even tempered.

The following[1] are a few instances of typical cases:—

CASE 1.—10th September 1900. Hunter mare, seven years old, in owner's possession one and a half years. Sluggish and troublesome when in the hunting field amongst other horses at period of œstrum; very often in œstrum.

Ovariotomy was performed under chloroform, and recovery was perfectly uneventful. On the 24th I received a note to say that the mare had been driven 25 miles the previous day, and that there was a distinct improvement in her method of going. On the 28th November: "She will jump and face anything, even in cold blood. Without doubt there is a decided change for the better in her character and temper"; and on the 24th January 1901: "The mare is simply splendid, and I have had some good sport on her." Since then there has been no return of the objectionable symptoms. This improvement has been maintained, and there is no special tendency towards obesity or laziness (December 1902).

The ovaries were examined by Professor M'Fadyean; the right one was small and cirrhotic, the left one normal in consistency and containing a lot of Graafian vesicles.

CASE 2.—16th October 1900. Hunter mare,[2] thirteen years old, continually in œstrum and very objectionable. When touched with the heel she would urinate profusely. Very dirty in her coat, and never could be got to look in condition. She had got much worse lately, so much so that the owner, a lady, had been unable to ride her. Recovery was quite uneventful after the operation. On the 17th November: "The mare squeals as badly as ever when touched behind the saddle, but I fancy is not quite so much inclined to kick. She is coming into condition, and the last time I saw her ridden with spurs (a fortnight ago) she certainly let the water fly from her when she was touched to make her extend herself." On the 19th December the owner wrote: "No water comes now"; and on the 10th January the veterinary surgeon for whom I had operated wrote: "The operation is a decided success." On the 26th March 1901: "She has ceased to exhibit any of the unpleasant symptoms complained of before the operation, and has been hunted all the season by a lady." The mare is going well at the present time (December 1902).

The ovaries, which were smaller than normal, were examined by Professor M'Fadyean, who merely stated that they were unduly firm in consistency.

[1] A more complete list of some thirty tabulated consecutive cases is given in the Appendix to the first edition ("The Castration of Cryptorchid Horses and the Ovariotomy of Troublesome Mares").

[2] "Veterinary Record," Vol. XIII., page 567 (Bloxsome and Hobday).

CASE. 3.—3rd April 1901. Carriage mare, eleven years old, had been in owner's possession six years, and very troublesome during the last two years when in œstrum. She had been much worse during the last few months, and had once lately kicked the brougham. She regularly lay on the pole and against the other horse, and was very objectionable as soon as she stood still, showing œstrum, etc. After the operation recovery was uneventful, there being absolutely no indication whatever by which one conld tell that any operation had been done. The animal has worked regularly ever since (December 1902), without the slightest relapse into her former indecent behaviour, and the owner has several times expressed his delight at the result. She is much cleaner in her coat than she used to be.

Professor M'Fadyean examined the ovaries, and stated that they were slightly cirrhotic.

CASE 4.—12th July 1901. Chestnut carriage mare, thirteen years old, always in œstrum, and very much worse during the past twelve months. She used to behave very objectionably, urine coming away from her. On one occasion she had started kicking. Recovery was uneventful. The ovaries were cirrhotic. The animal was put into harness again on the 23rd, and was driven from Balham to Brighton on the 29th. She has been in regular work ever since, and as recently as October 1902 I received a note from the practitioner in consultation with whom I had operated to say that "there was no tendency to obesity or laziness, and that the operation had unquestionably converted a dangerous brute into a useful animal."

CASE 5.—1st August 1901. Omnibus mare, seven years old, a very troublesome beast. She had recently commenced to kick viciously, and was quite unmanageable in single harness or saddle. She could sometimes be driven in double harness, but was very uncertain and unsafe. Always in œstrum. The left ovary was much larger than the right; both were cirrhotic. Recovery was uneventful, and the mare has since been worked regularly and with every satisfaction.

CASE 6.—17th October 1901.[1] Hunter mare, about nine years old, and in the words of the veterinary surgeon who called me in consultation, "frequently in œstrum, squeals, goes off her food, strikes out (apparently at nothing), urinates when put at a jump or when kicked with the rider's heels." Recovery after the operation was uneventful, and she was in the hunting field on the 23rd of the same month. There has been no return of the troublesome symptoms.

Professor M'Fadyean examined the ovaries, and stated that they were "unduly fibroid in consistency, and each contained two or three small Graafian follicles or cysts."

CASE 7.—17th October 1901.[1] Cart mare, eight years old, a vicious, kicking, squealing brute. About a week or ten days after the operation

[1] "Proceedings of the Lincolnshire Veterinary Medical Association," 17th October 1901; "Veterinary Record," Vol. XIV., page 306.

she was turned out to grass, and left there for a few weeks. When tried in harness again she took to it quite kindly, and has worked quietly and regularly ever since.

Professor M'Fadyean examined the ovaries, and stated that each contained a considerable number of cysts or Graafian follicles of quite unusual size, one as large as a pullet's egg.

CASE 8.—26th October 1901. Thoroughbred mare, seven years old, in owner's possession for six months. She was bought as a squealer and kicker both in harness or saddle. Recovery was uneventful, the words used by the practitioner in charge in a letter dated 29th October being, "the mare is going on first rate ; in fact to all appearances she is well." She was afterwards turned out to grass for a few weeks, and when brought up became gradually quieter, the ultimate result being a perfect success.

Both ovaries were cirrhotic, the left one especially so.

CASE 9.—9th December 1901. Hunter mare, seven years old, in present owner's possession about twelve months. Always in œstrum, and latterly a great nuisance. Squealing and passing urine continually, and lately showing a tendency towards using her heels. Recovery from the operation was uneventful. On the 20th January 1902 I received a letter to say, "As far as I am able to judge the operation on my mare has been completely successful . she does not appear to have suffered from the operation at all. I hunted her yesterday for the first time, and she carried me as well as ever. She was no trouble whatever after the operation." In October 1902 I saw the owner and he informed me that the result had been a perfect success.

CASE 10.—9th December 1901. Hunter mare, six years old, a kicker. The ovaries were cirrhotic and about half normal size. On the 26th I received a note saying, "The mare has made a perfect recovery, and has been at work a week. She never showed the least outward symptom of having been operated upon." The kicking propensities have all vanished, and she has since been sold for £100.

CASE 11.—8th February 1902. Polo pony, aged, excellent at her work, but squealed, kicked, and urinated profusely. Her tail swished continually from side to side ; she was always in œstrum, and sometimes very unwilling and troublesome. The right ovary was about twice the normal size. Both contained a lot of Graafian vesicles. She became perfectly cured of all her bad habits, but was never so good again at polo. In the words of the owner, a very hard rider, "it seems to have knocked all the stuffing out of her."

CASE 12.—22nd March 1902. Brougham mare, eleven years old, in owner's possession six years. Worked satisfactorily until a year ago, when she commenced to kick, squeal, and urinate when put in harness. During the last three months she had been quite unmanageable, and at the present time it was only with difficulty that she could be approached in the region of the hind quarters. It was impossible to harness her.

25th March.—Quite quiet to approach and handle. Progress uneventful so far.

9th April.—She was put in a jobmaster's "brake" and went quietly. On the 10th she had an attack of obstinate constipation, the body temperature on the 11th reaching 105° and the pulse 120. The cause was probably due to voluntary retention of fæces owing to soreness in pelvic region, and warm enemas, sedatives, and laxatives soon put matters right. Exploration of the vagina revealed the presence of a scar at the seat of incision and thickening of the tissue around it.

In a few days the mare recovered and was put to work in double and single harness, giving every satisfaction. There has been no relapse into her former bad habits.

The ovaries were sent to Professor M'Fadyean, who pronounced them abnormally small and cirrhotic.

CASE 13.—18th April 1902. Polo mare, eight years old, a splendid mare at her work, but very vicious and a dangerous kicker. She was a perfect brute and could not be approached in the stable even to be fed without danger, except by one groom. She would lash out furiously even when looked at. She had been like this for some time. Her ovaries were badly cirrhotic.

In this case the operation was a complete failure as, although she never took the slightest notice of the operation and was used at polo afterwards, she had not, up to the present time (November 1902), lost any of her bad habits.

CASE 14.[1]—22nd June 1902. Omnibus mare, eight or nine years old, in the present owner's possession two years. She had been troublesome for about ten months, squealing and kicking, and for the last six months too dangerous to use. She was now so dangerous that, before she could be approached, it was the custom to throw a slip noose over her head and pull her to the box door. She was condemned to be destroyed if ovariotomy proved useless.

The operation was performed under chloroform, both ovaries being badly cirrhotic and cystic (M'Fadyean).

On the 26th I received a note to say that the mare had never missed a feed. On the 23rd she swished her tail a little, on the 24th stamped her foot and squealed in a half-hearted way, but when her head was held she could be stroked, patted, or even rubbed over with a brush, without causing any serious signs of irritation.

On the 2nd July she was sent to work, being perfectly quiet in harness and to clean and handle about the legs. She still squealed and struck out with the fore feet in a half-hearted way when the bridle was put on, so that this had to be done over the box door, but in harness and to be harnessed she was quite manageable. She worked regularly until the 12th when, during the afternoon (this was Sunday and she had been at rest all day), she was suddenly seized with violent abdominal pain and died on the 13th of twisted gut.

[1] "Veterinary Record," Vol. XV., page 248 (Routledge and Hobday).

The *post-mortem* revealed a very large number of ascarides in the small intestine and cæcum. The ovarian stumps had healed perfectly.

CASE 15.—1st August 1902. Bay hunter mare, eight years old. When in œstrum she was very irritable and uncertain in temper; she would squeal and kick, urine squirting away involuntarily. She had got much worse during the past twelve months, and was now too much of a nuisance at these times to take into the hunting field. The ovaries were cirrhotic and cystic.

On the 6th August she was exercised. On the 30th I received a note from the veterinary surgeon by whom I had been consulted to say that "the mare made quite an uneventful recovery after the operation. She ailed nothing at all, and the owner is now riding her about his farm as usual. She has not yet quite got over her indecent habit, but the owner tells me she is not so bad as she used to be."

On the 17th October: "The mare has improved very much in temper and is quieter to ride, but still squirts out urine when touched. The owner is very pleased at the result, and we hope this other habit will disappear in time."

CASE 16.—1st November 1902. Hackney mare, eight or nine years old, troublesome during the past two years when in œstrum. She had kicked the trap on several occasions, and was now considered very untrustworthy, as during the past three months she has been constantly in œstrum, and unreliable in the London traffic. Both ovaries were cirrhotic.

The subsequent report said: "There has been no constitutional disturbance whatever, the mare has behaved as if nothing whatever has ever been done to her."

Recovery was quite uneventful, and she was put to work in a fortnight.

The latest report says: "The mare has worked regularly, and has apparently lost all her objectionable habits. She can now be fed generously, whereas before we had to keep her low in diet. The owner is very pleased."

In some cases one ovary only may be diseased, and its presence may cause so much pain and irritation as to prevent impregnation, whereas its removal may give the desired result.[1]

An interesting illustration of this occurred in a thoroughbred mare, six years old, operated upon on the 9th March 1901. She had had a foal by Perigord in 1889, but had been barren since. Her perinæum had at some time or other been badly torn. Insemination had been tried without success. She was always in œstrum. A practitioner who had examined her had diagnosed extensive disease of an ovary, but as to which one I could not get a definite opinion. The owner wished the diseased ovary to be removed in the hope that there might be got a foal subsequently. Upon gaining access into the abdomen it was found

1 "Veterinary Record," Vol. XV., page 210 (Page and Hobday).

that both were undoubtedly diseased, being hard and cirrhotic. The right one appeared to be the worst and was removed, the left one being allowed to remain behind.

On the 11th I received a letter saying "the mare seems quite her old self again and is feeding." On the 30th and at subsequent periods she appeared in œstrum again and was served twice. The first time she "missed," but on the second occasion she "held," and the result was a fine healthy foal.

At the present time (December 1902) mother and foal are looking well, and she is again, so far as one can tell, pregnant.

Condition of the Ovaries. — In troublesome mares, as a rule, an abnormal condition of the ovaries exists. They

Fig. 65.—A small cirrhotic ovary and one which is enlarged and cystic (about one-fourth natural size).
A normal ovary is in size about midway between these two.

may be two or three times the normal size, in which case they are **cystic** and contain a lot of Graäfian vesicles in various stages of development, or they may be **cirrhotic** even to cartilaginous hardness, and very small. It is impossible to tell with certainty, except by manual examination, which condition exists. In some instances there may be nothing very abnormal to all external appearances, and yet their removal may have the desired effect.

Power of Procreation.—Although it is frequent to find that mares which are constantly in œstrum, and those which are known for their vicious, squealing, urinating and general nymphomaniac propensities, will not breed, even if repeatedly

served by different stallions, the rule is not by any means a constant one.

In one instance brought before the notice of the author the mare was one of the worst and most objectionable brutes imaginable. She was known to have been "covered" several times, but it was never even suspected that she could be pregnant. Yet a *post-mortem* examination demonstrated this fact, which perhaps ought to have been discovered at the time of operation, had not the owner been so very emphatic upon the point as to cause those present to coincide with his opinion.

That a certain amount of cirrhosis will not prevent breeding is illustrated by the case detailed on page 113, in which a manual examination of both ovaries revealed them to be cirrhotic and much harder to the touch than normal. The worst diseased one was removed, and the mare afterwards had a foal and has become pregnant for a second time.

Preparation of the Patient before Operation.—As in the case of the cryptorchid patient, the intestines should be kept as empty as possible. A dose of physic may be given a few days beforehand, although this practice is by no means necessary, a laxative diet and twenty-four hours' enforced abstinence from food being all sufficient. Care must be taken that the bedding is not eaten, and a limited supply only of water should be given early on the morning of the operation. If an enema is used to empty the rectum this should be done at least an hour beforehand, or some of it may return and soil the arm of the operator and perhaps contaminate the vagina; sometimes it is wise to empty the bladder with a catheter or by inserting a finger into the urethral orifice. If the mare will allow it, the under surface of the tail, the perinæum, vulva and surrounding parts should be well washed with soap and hot water containing disinfectant on the morning of operation. This is, of course, again washed thoroughly immediately before operating.

Methods of Securing.—No special method of securing is necessary if the patient is operated upon in the recumbent posture. It is better, if possible, to cast with hobbles than with a rope, as

the position of the legs in the former case causes less pressure upon the abdomen, and consequently more room and facility for the movements of the operator. The side upon which the patient is thrown depends entirely upon the operator's fancy; usually the right side is the one which is chosen, but sometimes it is an advantage to remove the left ovary when the animal is on the right side, and then turn her over to reach the right one. When operated upon in the standing position the mare should be placed deeply under the influence of chloral or morphia, and

Fig. 66.—Position of operator during operation.

then safely secured with hobbles or side lines, or else in a trevis fixed safely with a sling to prevent the patient from lying down. Of the two it is easier to operate in the standing position, but in the prone position one has the advantage of chloroform.

In Texas and the Western States of America,[1] where large numbers of horses are reared and run wild, geldings are found to be much more reliable and valuable than mares from a sale point of view, especially on those ranches from which army

[1] For this description I am indebted to Dr F. Thacher, one of the veterinarians of the State of Texas, U.S.A.

supplies are drawn. In the United States Army no mares are purchased when geldings can be obtained, and even for cow-punching and ordinary ranch work geldings are preferable, owing to the care which has of necessity to be exercised when riding mares during the months of pregnancy.

With spayed mares this trouble is done away with, and in times of urgency, due to war or other causes, these animals become a marketable commodity. As a rule the proprietor of a large ranch will have a certain number done for the cow-boys to use, because he will thus be enabled to part with all his geldings when opportunities offer.

Those under the age of two years, in which the vagina is too small to allow of passage of the hand, are operated upon through the flank (on the left side, between the last ribs and the angle of the haunch) or through the median line (midway between the umbilicus and mammary gland).

The abdominal incision is made just so large that it will admit the hand, the mare being thrown and secured with ropes, and, after removal of the ovaries, allowed to return to the prairie. No attempt at after-dressing is made on account of the wildness of the patients, and it is not surprising that a certain proportion of deaths occur from peritonitis or protrusion of the bowels.

With the older and more roomy mares the vaginal method is practised, and, although no chloroform is used and the antiseptic precautions taken do not come up to modern ideas, the percentage of losses is very small.

The half-wild animals are driven into a wedge-shaped stockade, 6 feet high, termed a "chute" (*see* fig. 67), and as soon as one has arrived at the farther extremity (which is only about 2 feet 6 inches in width) bars are slipped in behind the quarters in such a position that the mare cannot injure the operator nor yet escape. In fact, she is scarcely able to move, being tightly wedged in. No ropes or other tackle are affixed. As a general rule the animal is too panic-stricken to kick, merely squatting down when the vaginal incision is made

or when the ovaries are being excised. After the operation the gate (A) is opened, the patient is turned loose on the prairie, and no further attention is paid to it.

Value and Choice of an Anæsthetic.—Both on humane grounds and those of facility and safety to the operator some general anæsthetic or deep narcotic should always be used. Ovariotomy is one of the major operations of abdominal surgery, and must of necessity, if no anæsthetic is used, be accompanied in the mare by a good deal of shock and pain; besides which, the violent straining which takes place when

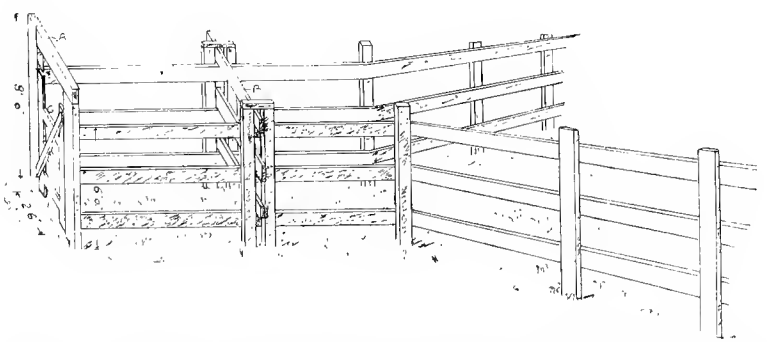


Fig. 67.—Diagram of "chute" (with sides about 6 feet high), into which the mare is driven and placed for operation. Her head passes through the space between A and G.

G. Gate, about 8 feet high and 2 feet 6 inches wide.

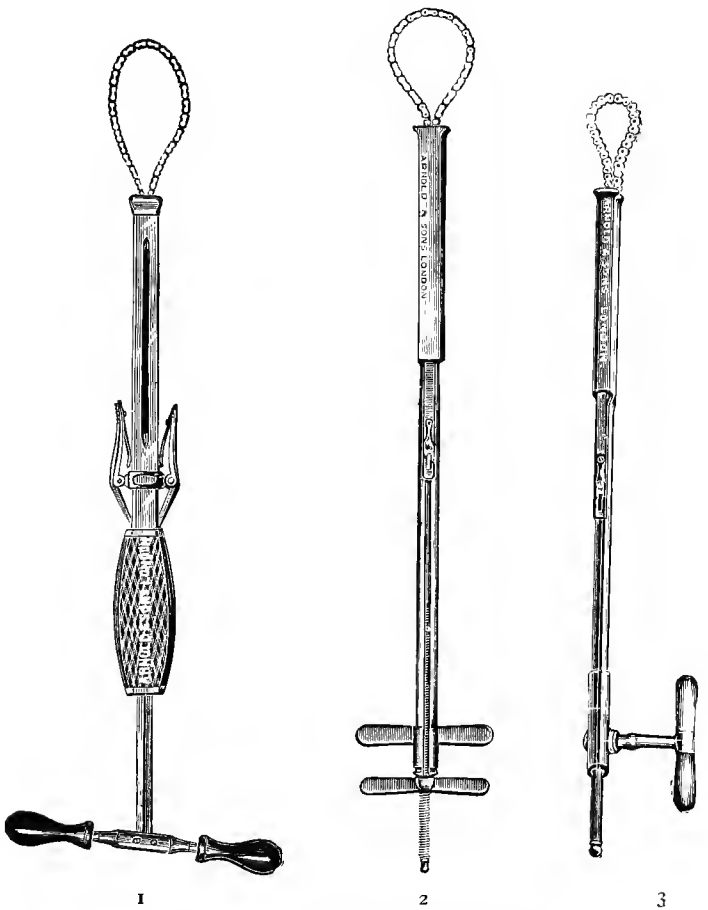
B. Set of rails to keep the animal wedged tightly in position and to prevent operator from being kicked.

the operation is performed without anæsthesia is liable to cause (either at the time or afterwards) expulsion of a quantity of bowel.

It is astonishing when chloroform is used and the operation has been done under modern antiseptic precautions how very little notice the patients take of it. In a large proportion of some ninety cases operated upon by the author the subsequent report made by the veterinary surgeon in charge said: "The mare feeds well and looks as if nothing had ever been done to her." Anæsthetics unquestionably lessen nervous shock, and

should be used wherever possible in all cases in which it is necessary to inflict pain.

If chloral is used it is generally administered *per rectum.*



1 2 3

Fig. 68.—Different patterns of écraseur.

1. Chassaignac (extra long). 2. French Pattern. 3. Author's pattern.

Four to eight drachms of chloral, mixed with mucilage and water, are given as an enema about half an hour or an hour before the operation is done, the rectum having been previously emptied. This produces dulness and stupor, and it is in this

latter stage that the mare is secured with side lines or put into the trevis.

Morphia, about 8 or 10 grains, injected subcutaneously, may be used for the same purpose.

Chloroform is, however, undoubtedly the best for the patient, both at the time and afterwards.

Instruments Required; Preparation for Operation. — The instruments required are a clean enema syringe, a specially made knife with guarded blade,[1] and an écraseur[2] or some instrument for excision of the ovaries. A speculum is also advised by some operators, but it is not a necessity. The knife and écraseur, or torsion forceps, together with all cotton-wool to be used in the interior must be carefully sterilised, either by boiling or by immersing for some considerable time in a reliable solution of some disinfectant. The enema syringe must be a clean one, and may be either of Higginson's pattern or an ordinary metal one of sufficient size and calibre.

Preparation of the Operator's Hands and the Patient's Genitals.—The operator's hands, nails, and arms should be carefully scrubbed in hot water containing some reliable antiseptic (such as creolin, chinosol, perchloride of mercury, carbolic, etc.), and afterwards washed again in fresh antiseptic with ether or ethereal soap, care being now taken that the hand and arm which must enter the abdomen shall not afterwards touch anything which could contaminate it. At the same time an assistant similarly washes the under surface of the mare's tail, the vulva, anus, and perineal region, drying it with sterilised wadding or a clean cloth. Care must be taken to cleanse the interior of the lips of the vulva, as smegma is often present there, and is apt to soil the hand or arm when entering.

The vagina is filled with warm antiseptic solution—creolin (1-50), or chinosol (1-500)—and this is allowed to come in

[1] Messrs A. Munro and A. Holburn have in two cases successfully improvised an ordinary scalpel with the blade partially concealed by antiseptic tow ("Veterinary Record," Vol. XV., page 213).

[2] It is always wise to be provided with two chains in case of accident.

direct contact with the interior of the vagina for at least ten minutes. The hand is then introduced and moved to thoroughly agitate the fluid, which is now aided to escape. Afterwards, with sterilised cotton wool and fresh chinosol solution, the vagina is swabbed out and dried. The patient is now quite ready for the operation.

It is necessary to attend carefully to the above details, because sometimes the vagina, especially in troublesome œstral mares, contains a lot of slimy mucus adherent to its walls, and mere syringing is not sufficient to remove it. In special cases where a discharge has been observed for some time, and especially where it has been found purulent, the vagina should be syringed with antiseptic three or four times a day for several days previous to operation.

Surgical Anatomy.—On introducing the hand between the lips of the vulva one passes through a constricted portion into a hollow cavity—the vagina itself. At the far end of this, a little nearer the roof than the floor, is to be felt the mouth of the womb. This may be tightly closed or sufficiently open to admit the end, or even the whole length, of a finger. Immediately above this, when the mare is in a standing position, is the spot selected for the incision; it is here that the blood vessels of the vagina are fewest in number and of the least importance. Upon introducing the hand, with the palm downwards, into the abdomen one feels a soft, smooth body just on the other side of the os. This is the body of the uterus, and by following this along the operator can, if he has not at once found the ovaries, readily discern each horn, and eventually reach the ovary which is at its extremity. The ovaries hang, one on each side, under the loins just behind the kidneys, attached by a fold of peritoneum. In disease they vary in size from a small walnut to a large cocoanut, and in shape they are very much like one or other of these fruits, although the external surface is not always regular. To the touch they may feel very hard or soft and cystic. They receive their blood supply through the ovarian arteries, and are plentifully supplied with

Fig. 69.—Anatomical situation of the ovaries, the intestines having been removed.[1]

1. Diaphragm; 2. Liver; 3. Stomach with spleen attached; 4. Left kidney; 5. Portion of rectum; 6. Body of uterus; 7. 7. Right and left ovary at the extremity of their respective horns.

[1] For this sketch (taken from the body of a virgin mare, twelve years old) I am indebted to Mr C. C. Abram, M.R.C.V.S.

veins. It is a wise plan for an intending operator to make himself acquainted with the external form and feel of ovaries from different subjects beforehand.

The rectum is situated just above the uterus, and the coils of intestine are all around it, so much so that when the mare is cast for operation great care must be taken not to include a small piece of this in the loop of the éraseur chain.

Description of the Operation.—The operator, having attended to the cleansing of his hand and arms, kneels or lies down behind the mare's hind quarters, whilst an assistant holds the tail

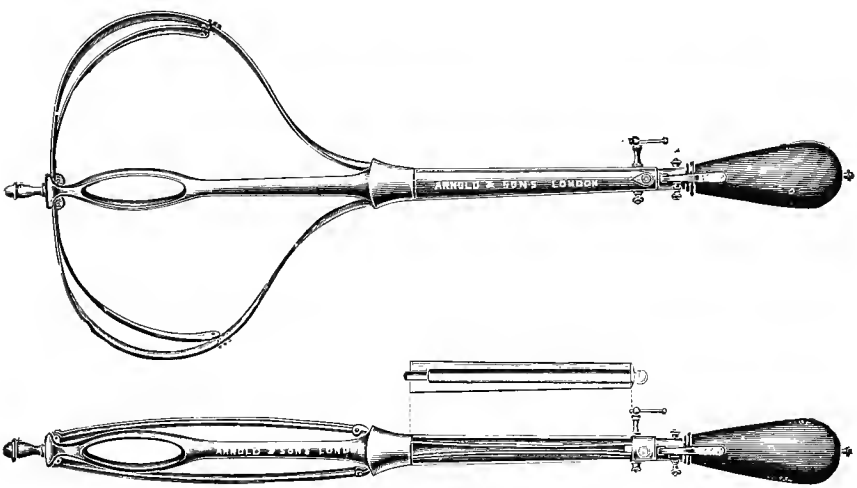


Fig. 70.—Vaginal speculum.

out of the way. If a speculum is used (it is not at all essential) it is fixed in position now. Compressing his hand into as small a space as possible, he takes the knife (with the guard closed) in the hollow of his hand and passes it slowly and steadily into the vagina as far as the os uteri. This may cause a little straining on the part of the patient, and, if so, a momentary interval should be allowed. The blade of the knife is placed against the mucous membrane of the vagina (in a position which would be vertical if the mare were on her feet) above the os—*i.e.*, between the os uteri and the spine—and the guard

withdrawn. Some operators advise that the puncture shall be made below the os.[1] I have tried both situations, but (unless the space above the os is abnormally small) prefer this position, as there is less likelihood of intestinal protrusion afterwards. The chief thing to be said in favour of the lower puncture is that the plunge of the knife is made at a further distance away from the aorta and rectum than when made above. When she is perfectly still a short, sharp plunge is made in a forward and slightly downward direction, the object being to merely puncture the whole of the coats of the vagina without injuring any of the abdominal organs or vessels. It is important to ensure incision of all the coats with the knife, as, if an attempt is made to puncture the peritoneal lining with the finger, this covering may recede and give rise to the formation of a pouch with perhaps unpleasant sequelæ.

In a thoroughbred racing mare, eight years old, operated upon on the 15th October 1902, with the history that she was of a nervous disposition but unreliable when excited by the shouting of the crowd, at which time, especially if in œstrum, she would completely give up trying to win, both ovaries were found by Professor M'Fadyean to be cirrhotic. She was not in any way prepared, but was operated upon whilst in hard training. In making the incision the knife blade did not puncture the peritoneum, and this covering was ruptured with the finger nail, but the procedure was made somewhat difficult as my nails were short and blunt and the peritoneum receded very considerably. I am inclined to think that on this account a large blood clot found its way between the vaginal coats, and, as some considerable hæmorrhage occurred, gave rise to a subsequent swelling in the vagina, causing the patient a good deal of pain.

17th October. Mare dull and listless; refused food.

22nd October. Pulse 70, temperature 103°; very dull.

26th October. Temperature 101·5°; mare stretching out hind legs and straining frequently. An examination *per vaginam* revealed a jagged ulcerating place about the size of a shilling where the mucous surface had not healed, although there was no communication into the abdomen. The edges of this, and the parts adjacent, were carefully cleaned with antiseptics. Sedatives were administered by the mouth, and the patient kept as quiet as possible. Exercise gave rise to a good deal of pain. A fine trocar and canula was inserted, and about half a pint of clear serous fluid withdrawn.

7th November. Between 26th October and this date the swelling gradu-

[1] "Proceedings of the National Veterinary Association at Plymouth," 1899; "Veterinary Record," Vol. XII., page 261 (Lukes).

ally became larger again, the mare being continually in pain, but on the 8th a lot of slimy discharge came away from the vagina, so that I surmise the swelling had burst, as from that date it gradually became less. Antiseptic irrigations were used, and recovery was practically uninterrupted.

After the middle of the month all evidence of pain disappeared, and she was put to work again on the 25th.

The guard is then replaced and held in position, whilst more of the knife is inserted to lengthen the incision. This instru-

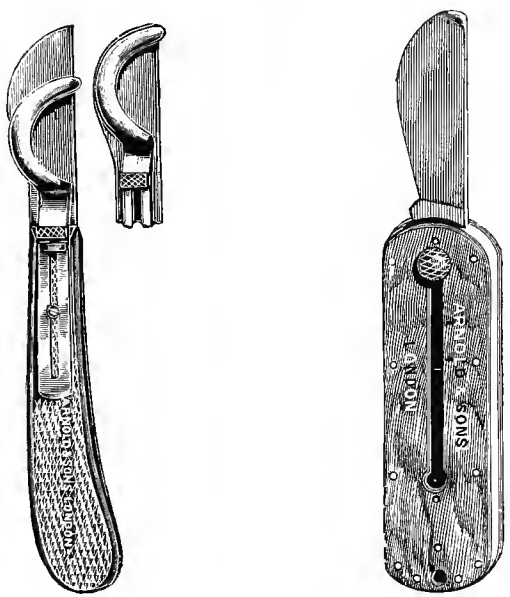


Fig. 71.—Two patterns of knife with guarded blade.

ment may then be dispensed with, and may be either withdrawn altogether (the safer plan) or allowed to fall on the vaginal floor. With the fingers, inserted one at a time to commence with, then two or three together held wedge-shaped, the opening is made sufficiently large to admit the whole hand. It is better to tear the wound open in this way than to lengthen it with the knife, as there is less danger of severing any of the arteries of the vagina. The ovaries are then sought for. In size they may vary from a walnut to a large cocoanut, and to the

touch they may be hard and cartilaginous or soft and cystic. They hang dependent from the spine within easy reach of the hand when just passed through the vagina as far as the wrist, and if any difficulty exists in finding them, can be readily discovered by manipulation towards the extremities of the horns of the uterus. Taking one ovary at a time, the organ is held in the palm of the right hand, whilst the operator, with the left, passes the écraseur into the vagina and abdomen, using

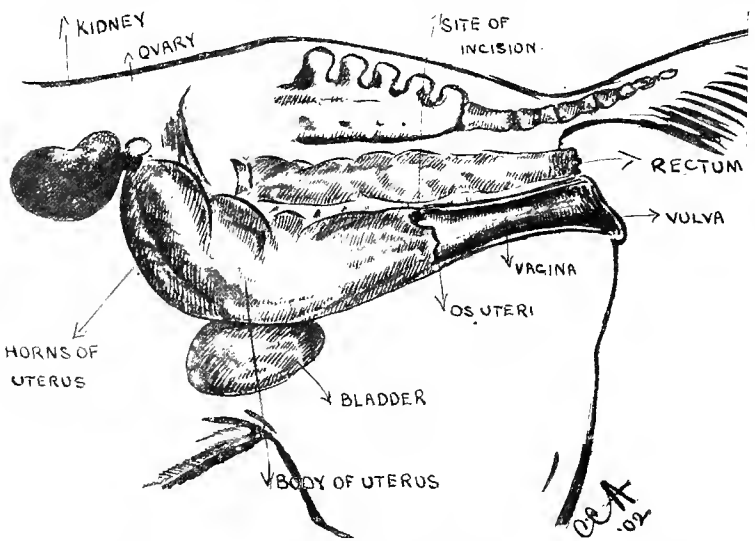


Fig. 72.—Diagram showing the relative position of the pelvic organs and the site of operation.[1]

the right arm as a guide. The écraseur chain is then looped carefully over the ovary (which is retained in the hand), and tightened very slowly by an assistant until the organ is pinched or torn off. The chain is left on for a few moments to ensure absence of hæmorrhage, and the same process is repeated with the other. It is not generally necessary to withdraw the écraseur until both have been taken off, but each ovary should be completely withdrawn as it is detached or it may be lost

[1] For this sketch I am indebted to Mr C. C. Abram, M.R.C.V.S.

in the abdomen. The vaginal mucous membrane is again swabbed out (not syringed) with sterilised cotton wool which has been wrung out in chinosol or some other antiseptic solution, and the operation is complete.

Care must be taken not to remove a piece of bowel by mistake or to injure any of the abdominal organs. Bowel, if empty, has a soft, pultaceous feel totally different to that of ovary, and if full can be distinguished by the presence of a succession of lumps of fæces in a continuous row. Care, too, must be taken not to excise the ovaries too high up or otherwise unnecessarily injure the uterus, nor to include anything beside the pedicle of the ovary in the chain at time of excision. If the écraseur chain is a good one and not sharp, and the operation passes off properly, there is scarcely any blood whatever to be seen either at the time or afterwards.

Prognosis and After-Treatment.—If the operation has been done antiseptically and under chloroform the result will be excellent. As a rule the mare, except for a little trembling and raising of the tail during the next twenty-four hours, does not show the slightest deviation from health.

In one instance operated upon by the author, the owner (Mr C. Hartley, F.R.C.V.S.), rode the animal hunting on the sixth day afterwards, and no ill effect followed.

Unless something untoward occurs, no special after-treatment is necessary. It is astonishing how quickly the vaginal wound will unite. On no account, if the patient appears all right, should any swabbing or syringing of the vagina be attempted, the vulva and external genitals alone being daily swabbed with antiseptic and kept clean.

A clean loose-box or stall and good hygienic arrangements are of course essential. Diet should be sparing and laxative, as the collection of hard fæces in the rectum causes a certain amount of soreness and pain for a few days during evacuation, and in some instances a dose of Epsom salts or of oil is a wise measure. Walking exercise should be given on the third day, and the mare can be put to gentle work in a fortnight or three weeks.

She may be immediately cured of all her bad habits, or they may persist for a few weeks or even months, disappearing gradually. Sometimes they will not have completely gone until after the following spring, and in other instances it is a good plan to turn the patients out to pasture to give a little time in which to get in good condition and forget their vices.

If the troublesome habit has existed for less than six months a satisfactory prognosis can generally be anticipated. If the mare has been a confirmed kicker for years the result is uncertain.

Between 1888 and 1893 Professor Cadiot states[1] that he operated upon eighteen nymphomaniac mares. Eight became cured, three improved, in five cases there was no change, and the remaining two were lost sight of.

M. Schwendimann reported[2] statistics of sixteen vicious mares belonging to the Swiss Army. In seven cases complete cure resulted, and in four others there was an improvement.

It has been said that a spayed mare will get fat and lazy, but very often improper feeding and want of exercise have a great deal to do with this; certainly in instances where mares could not be got into condition before the operation they afterwards became well and sleek.

The removal of one diseased ovary may even allay a mare's sexual irritation sufficiently to allow her to afterwards breed a foal.[3]

Abnormalities.—These are practically confined to three conditions, viz.: Deviation from the usual position; secondly, an exaggerated cystic condition whereby the ovary may have become so large that the usual size of écraseur chain cannot be passed over it[4]; or, thirdly, some difference in shape or cystic attachment, as illustrated by fig. 73. If the second above-mentioned condition has existed for some time the weight of the ovary may have so lengthened the pedicle as to make it a

[1] "De l'ovariotomie chez la jument et chez la vache."
[2] Foreign Abstract (translated by H. G.), "Veterinary Record," Vol. XI., page 145.
[3] "Veterinary Record," October 1902, page 210 (Page and Hobday).
[4] "Veterinary Journal," January 1906.

difficult matter to guide the organ itself through the loop without including some portion of intestine. If the ovary is too large the fluid must first be removed. This may be done either by puncturing with a sharpened canula, to which a rubber tube is attached, the contents of the cyst then escaping through the vagina, or by rupturing the wall with the finger nail. When the latter is done the contents may fall into the abdominal cavity, but, if not septic or purulent, need give rise to no alarm.

Fig. 73.—Loose cyst, with long pedicle, hanging from the wall of the ovary.

On 5th December 1902 I operated upon a cart mare, nine and a half years old. She had had one foal six years before. During the past nine months she had been in œstrum about every fortnight, and very vicious during the "period." In October, when going down a hill, she became suddenly hysterical, kicking violently and becoming unmanageable. A serious accident resulted, and the owner (who had the matter under consideration for some time) now decided that she must be spayed or shot.

The left ovary, when removed, was cirrhotic and about normal in size; its weight was $1\frac{3}{4}$ ozs. The right ovary was much enlarged and cystic, being quite as large as a swan's egg. It was too large for the loop of the écraseur chain to be passed over it, and this weight had lengthened the

pedicle upon which it hung to such an extent that it was very difficult to manipulate. The exterior, too, was very tense and smooth. Eventually, with the finger nail, the wall of the largest cyst was ruptured, and the contents allowed to escape into the abdominal cavity. The ovary then collapsed to an extent sufficient to permit of the passage of chain over it, and removal was readily effected. When examined afterwards it was found that there were two enormous cysts, one of which (as accurately as could be estimated by filling with water) would hold 3 ozs. and the other 2 ozs. of fluid. The collapsed ovary (without the contents of either cyst) weighed 6 ozs.[1]

On 22nd December I received a letter saying: "The mare never 'looked back' in the least from the operation, and feeding well and heartily as though nothing had ever occurred. She has only worked in the chain gears up to now, but with perfect manners so far." Since then a further communication states: "The mare is behaving very well, putting on flesh and working either in shafts or chains without showing the least trouble, so that we may therefore consider the operation a complete success."

In another case operated upon on 10th December 1902, a cob mare, seven years old, which had been in the present owner's possession about three months, but was known previously to be of uncertain temper. She was almost continually in œstrum, and during those periods would kick unexpectedly and violently in harness. She was very dangerous to approach in the stable, kicking at the groom most viciously.

Both ovaries were cirrhotic. The left ovary was slightly different to normal in that it had a pendulous cyst,[2] with a pedicle about 1 inch long attached to one edge. This puzzled me for a few moments, as I was not quite sure what it might be, but eventually it was included in the chain loop and removed. A small piece of omentum, about 1 inch square, was removed at the same time, it having been pushed into the chain covering the surface of the ovary.

Recovery from the operation was quite uneventful, and the mare went back to work.

M. Jacoulet reported a case to the Société Centrale de Médécine Veterinaire of Paris, in which a large ovarian cyst gave rise to obstruction and fatal colic. It weighed 5 kilogrammes, and filled up the pelvis, completely surrounding the rectum.[3]

Influence of Age and Time of Year.—In regard to the safety of the patient the age does not appear to be of material importance, but it has some considerable bearing upon the ultimate success in curing the vicious propensities, although the length of time these have existed is a much more important item. The operator may talk of a successful sequel in a mare

[1] *See* fig. 74.

[2] *See* fig. 73.

[3] "Veterinary Journal," December 1907. (Translated.)

under eight or nine years with much more confidence than in one over that age. As a rule, if an old mare becomes an inveterate kicker, even when the primary cause has been removed, the habit still persists.

The season of the year to some extent influences the periods of œstrum, and it is better, if possible, to operate when the mare is not in that condition. It is not a matter of vital importance, but as there is always more congestion at these times in the blood vessels of the genitals there is more risk of

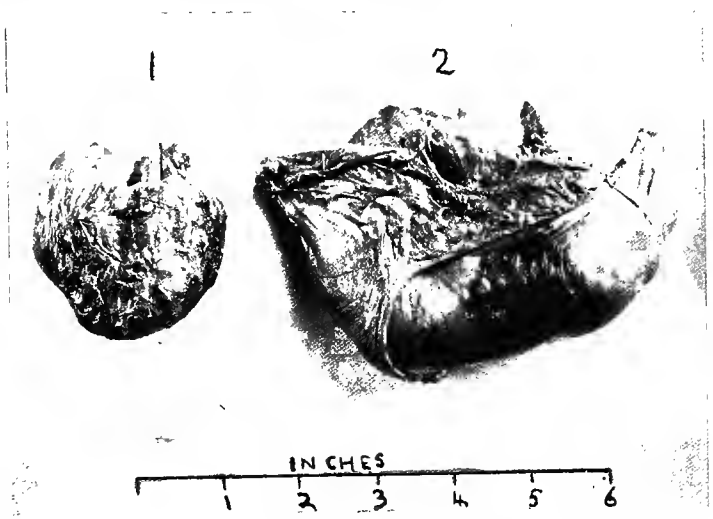


Fig. 74.—(1) An ovary of normal size. (2) An abnormally large and cystic one.

hæmorrhage, especially if the ovaries are removed rapidly. In many instances the continual "period" makes it impossible to operate except during the time the animal is in this condition, and the author has operated upon a number of cases which were in full œstrum when operated upon. They did not in any way show systemic disturbance in consequence. Beyond this factor the weather need not be taken into consideration so long as the patient is afterwards placed under good hygienic conditions.

Untoward Sequelæ.—The untoward sequelæ to be feared

are those of surgical shock, injury to (and even removal of) a piece of bowel, protrusion of the intestine through the vaginal wall, eversion of the rectum, hæmorrhage, colic, the formation of a serous swelling or an abscess at the seat of operation, and peritonitis.

When done under chloroform the danger of bad effect from surgical shock seems practically *nil*. Should it occur and the patient refuse food, etc., the symptoms must be treated as they arise.

Sometimes a mare's bad habits will be cured and her spirit appear broken, but this is rather the exception than the rule.

To avoid injury to the intestine great care must always be taken during the introduction and manipulation of the écraseur. The inclusion and removal of a piece of intestine would inevitably result in death.

Protrusion of the intestine through the vaginal wall is much more likely to occur when the operation is done without an anæsthetic, and especially if the operator has made a large wound in the vaginal wall. It is also more liable to occur when the vaginal wound is made below the os uteri, as when made above this organ partly occludes it if the intestines are forced up against the vagina from below. In the event of such an occurrence the intestine must be cleansed with antiseptic and returned. The operator need not despair of success even then, as it has occurred and been successfully returned.[1] It may be necessary to fill the vagina with sterilised wadding or tow, care being taken that none of it falls through the wound into the abdominal cavity.

Similarly with **eversion of the rectum.** Violent straining, when no anæsthetic is used, may lead to this, and it may even become irreducible.[2] If, after reduction, it again protrudes, sutures should be inserted across the anus or some form of pessary improvised.

[1] "Le Bulletin Vétérinaire," No. 58; "Veterinary Record," Vol. XV., page 213 (Munro and Holburn).

[2] "Veterinary Record," Vol. XIII., page 242 (C. Pierce).

Hæmorrhage should not occur if the écraseur chain is a blunt one and the removal of the ovary is effected very slowly. One must not forget the risk of puncturing the aorta when making the vaginal incision. Such an eventuality would be almost certain to lead to a fatal result. The possibility, too, of aneurism must not be forgotten.[1]

Bleeding from other vessels, if considered sufficiently serious, might be stopped by the application of small artery forceps, which could be removed after about fifteen or twenty minutes. If aseptic and left on altogether they would probably become encapsuled. Such a condition has been recorded by Professor M'Queen.[2]

If **colic** occurs it is treated on the usual lines, drugs (such as large doses of opium or cannabis indica) which quieten peristalsis being especially indicated, and warm enemas given to keep the contents of the rectum soft and to soothe the pelvic organs.

A **serous swelling** may result as the consequence of hæmorrhage into a pouch between the vaginal coverings, but, unless causing severe pain, need not necessarily be lanced. Warm irrigations will hasten its absorption, and opium, or other sedatives, may be added to the water.

If an **abscess** forms and bursts internally the probability is that the patient will die; but if it is lanced or the contents escape into the vagina this must be irrigated or swabbed out with antiseptics. Its presence is indicated by loss of appetite, pain and general uneasiness, accompanied by high temperature. Careful vaginal or rectal (or both) exploration should be made, the abscess being detected as a soft palpitating body under the fingers. It should be lanced as soon as is considered expedient, and the surrounding parts kept clean by syringing or swabbing with an antiseptic.

Peritonitis should be treated immediately by the internal administration of antiseptics and opiates, and by the external

[1] "Veterinary Journal," 1912 (Routledge).
[2] "Proceedings of the National Veterinary Association," 1894.

application of hot rugs covered with waterproof sheeting and affixed to the body with surcingles. If only local, and not due to septic causes, it need give no alarm. The vagina should be kept clean with warm antiseptics.

In connection with peritonitis and the formation of an abscess it is worth while to bear in mind that, in a mare with a wide vagina, air will sometimes be heard to rush into the abdomen. It is always possible, if the bed upon which the animal is cast is made of some dusty material or the air is otherwise infected, that this may prove a source of infection, and care should be taken to avoid it as much as possible.

Two cases operated upon by the author died of twisted gut within a short time afterwards. Whether this could be attributable to the operation or was merely coincidence it seemed hard to say definitely. Further statistics may perhaps help to decide the point, which is worth noting. There was no recollection of having punctured the omentum in either case.

Concluding Remarks.—Considering the apparent severity of the operation it is really remarkable what very slight (if any) systemic disturbance occurs when it is performed under anæsthesia and with strict adherence to antiseptic precautions. These are, however, essential to an uninterrupted series of successful results. In opening such an important cavity as the abdomen one must not forget that a septic infection cannot take place without the presence of septic organisms, and that under natural healthy conditions these are not present. If, therefore, a septic peritonitis takes place after an operation the operator must be prepared to satisfy himself, at all events, that something connected with his hands and instruments was not the primary source of infection. *Scrupulous surgical cleanliness is the first essential to success in all major operations, and it is absolutely necessary when any of the cavities of the body have to be opened.* The presence of disease of the uterus or vagina, especially if accompanied by discharge, must make the operator rather more cautious in giving prognosis, and, of

course, in each case an assurance should, as far as possible, be obtained that the mare is not pregnant.

The fact of the mare being in foal at the time of operation does not necessarily mean that she will abort. Fulstow has reported a case[1] in which he performed ovariotomy on a mare in January, and she was delivered of a live and healthy foal in the following May.

[1] "American Veterinary Review," December 1905.

CHAPTER VIII.

OVARIOTOMY OF CATTLE.

THE practice of spaying calves still exists in some counties of England, although not done to nearly the same extent as it used to be years ago. On large ranches, however, in America, where thousands of cattle are reared for beef-producing purposes, it is an operation which is done regularly on the young heifers. The object is to cause them to herd more quietly together and to fatten more quickly, and in these two things it is undoubtedly successful.

In dairy herds, especially in Switzerland, the operation is very extensively done upon the cows after eight or nine years old, when they are nearing the age at which their dairy utility is diminishing, and it is a remarkable fact that the milk supply is thereby increased in quantity and enriched in quality, whilst the period of lactation is extended to an average of about eighteen months, and some have been known to continue to give a paying quantity of milk even for three or four years.

M. Flocard, of Geneva, has spayed many thousands of animals in Switzerland, and in a letter sent to the author in June 1899[1] he stated that during the past twenty-two years he had operated upon no less than 5079 animals. Amongst the first 2000 animals there were about $\frac{1}{2}$ per cent. of fatal accidents, and a further 5 per cent. of minor complications, such as abscess, peritonitis, and return of nymphomania. Amongst the last 3000 animals he had had no deaths, and only 4 or 5 per cent. of secondary accidents of minor importance.

In 1895 M. Flocard published an article upon the subject in the *Bulletin de la Classe d'Agriculture de la Société des Arts de Gèneve* (1er trimestre, 1895, No. 141), and also read a paper before the Société Nationale

[1] "Proceedings of the National Veterinary Association," August 1899.

d'Agriculture de France (*Bulletin des Séances de la Société Nationale d'Agriculture de France*, Janvier 1898), which appear to prove conclusively the utility and advantages of the operation.

In the *Veterinarian* for 1834 (page 569) there is an account stating how a correspondent of the *United States Southern Agriculturist*, whilst spending a summer at an hotel kept by Mr Thomas Winn, of Natchez, observed two unusually fine cows always tied up in a byre. Upon admiring their fine condition Mr Winn informed him that they were of the ordinary common breed of the country but that they had been spayed, and were in their third year of lactation. Mr Winn stated that he had noticed in English magazines that the prizes in ploughing matches in the southern counties of England always went to spayed heifers, and it occurred to him to test the operation on lactation. He had had four cows done at different times, each having given milk continuously for several years.

In the *Veterinarian* for 1835 (page 629) there is an extract from the *Receuil* giving details of the operation performed by M. Negène, a veterinary surgeon of Bordeaux. One animal died four months later of symptoms resembling tuberculosis, and the other four, when reported upon nineteen months after the operation, were still giving the same amount of milk as at the time of spaying. Two of them had since been in œstrum.

The author concludes with the words: "This amount, on a fair calculation of the gradual diminution of the secretion, is double the amount that would otherwise have been obtained for the whole period."

In the *Veterinarian* for December 1835 (page 690) a report by M. Levrot, a veterinary surgeon of Lausanne, who operated upon five cows between June 1833 and January 1834, shows excellent results as regards the prolongation of lactation. The owner of the animals asserted that the milk was richer in cream, and that the annual increase in amount was fully one-third more than usual.

M. Levrot afterwards operated upon five more cases,[1] with one death on the following day from internal hæmorrhage, owing to the animal being in œstrum at the time of operation, both M. Levrot and the owner having observed at the time of operation that there was no hæmorrhage, and the animal having shown no signs of illness until the evening of the day following.

In the discussion on a paper on Castration, published in the *Abstract of the Proceedings of the Veterinary Medical Association* (1st Session, 1836-37), one of the members, Mr Gregory, stated that he had spayed deer, sheep, cows, and bitches, and that the Duke of Norfolk always had twenty or thirty spayed deer in his park, as they made earlier and better venison.

In the *Receuil de Med. Vet.*, 1850 (*Veterinarian*, April 1851, page 219), M. Roche Lubin gives a summary of eight cases. One died on the fifth day after, no *post-mortem* being made and no reason assigned. All the others fattened rapidly, but the period of lactation was not prolonged.

Up to this date the operation had always been done through the flank incision, but about this time M. Charlier, a veterinarian of Rheims, reported

[1] "Veterinarian," September 1838. Extract from the "Receuil" of July 1838.

upon fourteen cases successfully operated upon from the flank, his conclusions being as follows :—

1. That the animal gave the same quantity of milk as at time of operation for at least fifteen months.

2. That the milk was richer in cream and of more agreeable flavour.

3. That there was a marked increase of flesh followed by fattening without change of diet, the value of the cows being raised from about one-fourth to even one-half more than before the operation.

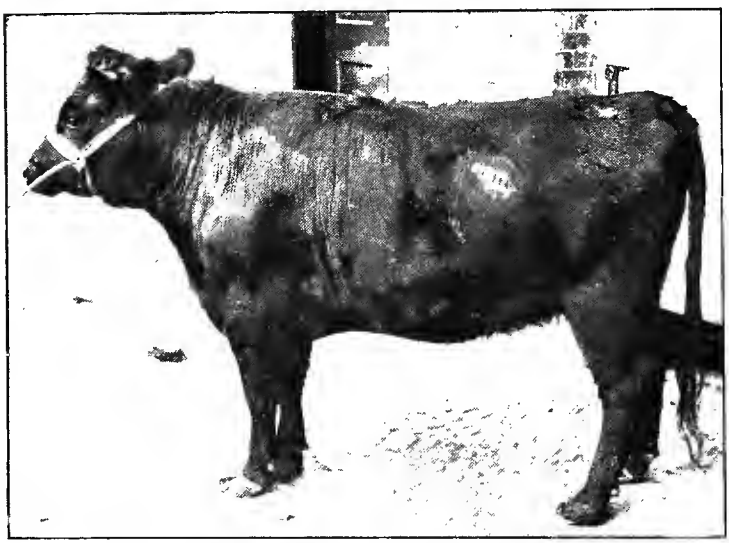


Fig. 74A.—The flank incision in ovariotomy of cattle.[1]

Heifers are spayed through the left flank, the milking cattle being operated upon *per vaginam*, and it is not usual for a general anæsthetic to be used in either instance, the animal being operated upon in the standing posture, and the parts to be incised anæsthetised with cocaine.

The methods of operating are respectively as follows (in each case the patient being starved for fully twenty-four hours beforehand): In the **flank method** the animal is tied up and "bull-dogs" placed on her nose, an assistant holding her by these and by the horns. Another assistant takes hold of the tail, and presses the cow against the side of the byre or wall,

[1] "Veterinary Journal," 1905 (Holbday).

whilst the operator shaves the hair off, injects the cocaine, paints with iodine, and makes an incision in the upper part of the left flank. With his right hand he seeks for the ovaries, and when found removes them with an écraseur. The wound is then sutured closely with boiled silk, and dressed each day with iodine, the stitches being removed about a week later. Calves are thrown down on the side, the hind legs being roped together and pulled well back, or three legs may be tied together and the upper hind leg drawn back.

For dairy cows the **vaginal method** is preferable, the procedure being as follows: After having washed the tail and external genitals the vagina is thoroughly syringed with some reliable antiseptic solution, and then swabbed out with sterilised cotton-wool. Solution of cocaine on cotton wool is then applied to the site of incision, and with a Colin's knife introduced in the right hand the vagina is punctured immediately above the os uteri; the knife is then withdrawn, and the fingers enlarge the opening sufficiently to admit the middle and forefinger, which are passed through in order to seek the ovaries. As a rule these can be found and withdrawn into the vagina without inserting the whole hand. With the left hand the operator passes the écraseur into the vagina, using his right arm as a guide, and the ovaries are placed in the chain, being pinched off *slowly* one by one.

As a general rule, beyond giving a certain amount less milk for three or four days, the cow takes no notice of the operation, but there are the risks of peritonitis and internal hæmorrhage to be considered, and the author has seen death from each as a sequel.[1]

It is certain that if the animal passes through the operation satisfactorily the average monthly supply of milk is greater, and the duration of lactation is prolonged for an average of from twenty to twenty-four months. In order to ensure this the animal should be operated upon about six weeks after calving. The milk supply is more constant, as there are not

[1] "Journal of Comparative Pathology and Therapeutics," June 1899.

the troublesome periods of œstrum, which, if they occur at all, are only short in duration. The milk, too, has been proved on analysis to be richer in cream and butter fat, and lactation is continued for a much longer time, whilst when the cow "dries off" she only needs about a month or six weeks of cake feeding to render her fit for the butcher; the flesh is, in taste and flavour, like that of the steer instead of that of an old cow. The actual yield of meat is said to be about 6 per cent. greater.

To M. Charlier, of Rheims, must be attributed the credit of introducing the vaginal method of operating, a method which gives infinitely more safety and causes less pain and after trouble than that of the flank.

The idea came to him one day after accidentally lacerating the vagina of a cow whilst examining the animal to see if she were in calf, and he performed 200 operations without any mishap.

About the same time M. Morin, a Government veterinary surgeon, operated upon twenty-seven cows between the ages of six and fifteen with excellent results upon the milk supply, particularly in those cows which were from six to eight years of age.

In the *Traité de la Castration des Animaux Domestiques* (reviewed in the *Veterinarian*, 1861) by M. Gourdon of the Toulouse Veterinary School, the author speaks highly of the vaginal method of operating, and quotes one dairy where the average amount of milk was 1890 litres per cow before spaying had been practised, whereas it had now become 3300 litres, the animals when put to fattening requiring less food, and the flesh resembling ox beef in quality.

In 1889 Dr Ostertag reported (*Journal of Comparative Pathology and Therapeutics*, 1889, Abstract from *Monatshefte für Praktische Thierheilkunde*), nine months after operating, the results of twelve oöphorectomies which appear to have been very satisfactory up to that time, both as regards the supply of milk and the general condition of the animals.

On several occasions papers have been introduced on this subject before the Central Veterinary Medical Society of Paris, one dealing with 117, and another with more than fifty, successful oöphorectomies, the ultimate results being favourably spoken of.

The late Professor John Gamgee tried some years ago to introduce the operation into England, but for some reason or other the attempt was not successful.

In a paper presented to the *Société Nationale d'Agriculture de France* in January 1898, one gentleman gave as the result of his experience :—

(1) That in the year following the operation, the animals being kept under the same care and diet, produced an average of 1300 to 1400 litres of milk more than if they had not been spayed.

(2) That the richness of the milk is considerably increased, particularly in butter-making properties; and, in addition, its flow remains constant, being no longer influenced by œstrum.

(3) That the absence of the troubles attending parturition and pregnancy is an advantage to the town dairyman.

(4) That the spayed cow fattens more quickly, the flesh being better in quality than that of the normal animal. The net yield of meat, too, is about 5 to 6 per cent. higher in spayed cattle than in those which have been allowed to become pregnant in order to fatten them.

In the discussion which followed several well-known veterinary surgeons and agriculturists spoke highly of the results which they had observed after the operation.

The author's personal experience has been confined to some ninety-three cases, of which three died from internal hæmorrhage within forty-eight

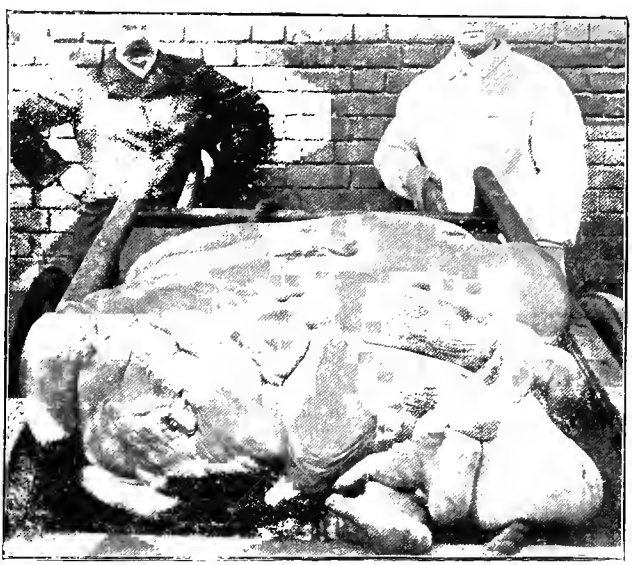


Fig. 75.—An enormous ovarian tumour.

hours subsequent to the operation. The vaginal method was practised, and the ultimate sequel on the cows which survived was excellent as regards the increase in milk supply and the improvement in the quality and quantity of the meat.

The Sequelæ are similar to those of the operation of ovariotomy on the mare (*see* page 132), and are to be treated in a similar way. The chief bad sequel to be feared, and which all operators appear to refer to, is that of uncontrollable hæmorrhage from the ovarian arteries into the abdominal cavity. It must

be guarded against by the slow use of the écraseur and by selection of a blunt chain. Emphysema occasionally follows the flank method of operating, air extending sometimes under the skin as far as the shoulders and neck. It is said, however, not to give rise to any disquieting symptoms, and to pass off without any treatment.

Enormous **tumours** are occasionally met with in cattle, such an one having been reported by Mr J. A. Jordan, M.R.C.V.S., Veterinary Inspector to the Belfast Abattoir. This tumour weighed 370 lbs., and had enlarged the abdomen to such an extent that the cow could not pass through an ordinary doorway.[1]

[1] "Veterinary Journal," January 1913.

CHAPTER IX.

OVARIOTOMY AND OVARO-HYSTERECTOMY OF THE SMALLER ANIMALS.

OVARIOTOMY AND OVARO-HYSTERECTOMY OF THE BITCH.

Reason for Operating.—The reason for operating is obvious to anyone who has kept a bitch or a female cat or monkey without permitting the animal to breed, as during the periodical œstrum in the spring and autumn the nuisance becomes intolerable, and in the case of the cat its occurrence is almost continuous all the year round. The removal of the sexual organs has in most instances the desired effect, and especially if done before an œstrum has taken place.

Occasionally one meets with an instance where the complete removal of the entire ovaries and uterus has failed to get rid of the sexual instinct, and the bitch or cat has been known to display amorous feelings, and even allow attempts at copulation[1]; so that although the practitioner may usually assure his client that the desired end will be accomplished it will always be wise to recollect that in this rule, as in most others, exceptions will occasionally and most annoyingly crop up. Of one thing, however, he can give assurance, viz., that the animal shall not become pregnant.

Choice of Anæsthetic.—For this operation either morphia or chloroform may be used, or, if preferred, the patient can be placed under the influence of morphia first and chloroform applied if considered necessary. In most instances, however, if the operation is commenced about three quarters of an hour

[1] "Veterinary Record," Vol. XII., page 15; "Canine and Feline Surgery," page 294.

after the hypodermic injection of morphia this agent alone acts quite satisfactorily.

Site of Incision.—For the site of the operation one has the choice of the flank, the abdominal wall immediately under the fold of skin which divides the flank from the lower abdominal wall, and the median line. Each position has its advocates, and it depends a good deal upon which situation the operator was first taught and in which he has gained experience. The scar which results is in a few months practically invisible, and the wound generally heals *per primam*. The only disadvantage of the median line is that if the patient is not bandaged and put in a clean place the wound is more likely to be soiled by contact with the floor than when done in the flank, but at the same time its healing is remarkably rapid, and there is no muscle tissue to cut through to cause hæmorrhage.

Preparation.—The patient should be prepared by being fasted from solid food for twenty-four hours, a little milk or beef-tea being allowed about four hours before the operation takes place. The site of incision, and some distance around it, should be shaved dry (without previous scrubbing or washing and painted with tincture of iodine, which is allowed to dry on, this being repeated when the animal is actually on the operating table.

The Operation.—The anæsthetic having been administered, and the patient placed on the operating table in the position most convenient for the site selected, the operator makes his incision through the skin, muscles, and peritoneum by the aid of a scalpel and director and inserts his middle finger, with the end of which he searches the interior of the abdomen for one of the uterine horns. This is best found by passing the finger in a downward and slightly backward direction close to the abdominal wall, and after pushing the intestines out of the way the uterine horn can be felt like a piece of string under the finger. If pregnant it is of course felt more readily.

In the event of any difficulty being experienced a probe passed into the vaginal passage and moved about with gentle

pressure can be felt by the finger in the abdomen, the uterus being traced up from this. Having found the uterus the horns

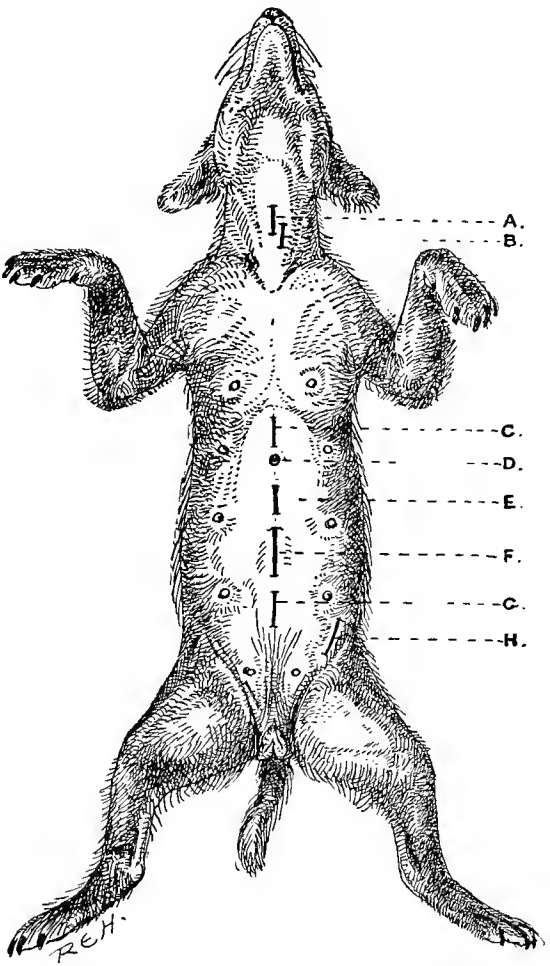


Fig. 76.—Sites of incision for various operations.[1]

A, tracheotomy; B, œsophagotomy; C, gastrotomy; D, umbilical hernia; E, exploratory laparotomy, oöphorectomy, and ovariotomy; F, ovaro-hysterectomy and hysterotomy (Cæsarean section); G, suprapubic lithotomy (female); H, inguinal hernia.

are withdrawn and removed in their entirety, or the ovaries

[1] Reproduced from "Canine and Feline Surgery." (Published by Baillière, Tindall & Cox.)

alone excised, at the discretion of the operator. In pregnant bitches, or when the uterus is of comparatively large size, it is wise to ligature above and below each ovary (or above each ovary and below the union of the two horns respectively) before excision, two ligatures being put on in each case, and the incision made between. Where the uterus is of small size there is no need whatever to apply ligatures, the tissues being simply scraped slowly through. For ligatures, either boiled silk or sterilised catgut are the best.

From an experience of over 500 ovariotomies or ovaro-hysterectomies in the bitch and cat the author is of opinion that the operation can be done with absolute safety provided antiseptic precautions are followed, and that it is quite a matter of indifference so far as results are concerned whether the ovaries alone are removed or whether the uterus is taken away as well. The patient appears to suffer no shock in either case, and is usually feeding the next day as if nothing had happened. In fact, as a rule, it is better to remove the whole of the uterus, for in one instance in which the animal became gradually thinner the cause of this was found on *post-mortem* to be that the two severed cornua had become attached to a loop of the bowel and caused sufficient obstruction to interfere with nutrition.

Prognosis.—The prognosis is excellent, death from either of these operations in a healthy bitch being quite a rarity provided the ordinary rules of antiseptic surgery have been carried out.

Complications and After-Treatment.—The dangers to be guarded against are those of peritonitis, hæmorrhage, and escape of the omentum or bowel (or both) through the sutures giving way. The latter may occur if the bitch licks the wound persistently, but *it can be taken as an almost invariable rule that neither a bitch nor a cat will interfere with the sutures if there is no irritation present, and that it is the irritation caused by the presence of pus which gives rise to this, so that if the wound is free from pus the incitement to lick is not present.*

To avoid the above complications the surgeon must attend carefully to the sterilisation of his hands, his instruments, and

the skin of his patient, whilst to avoid unnecessary hæmorrhage he must use discretion and care in ligaturing vessels before cutting through them. At one time the author preferred to hermetically seal up the wound, after suturing, with iodoform and colloidin, but of late years the method adopted has been to merely paint the surface over once or twice a day with tincture of iodine, and only in very rare instances has it been necessary to bandage or even to touch the place again until the sutures were removed about the sixth or eighth day. Animals are not fond of bandages, and if these can be avoided it is better to do so.

OVARO-HYSTERECTOMY OF THE PREGNANT UTERUS.

This operation is necessary in certain cases of dystokia, and is very successful if the patient is not exhausted and the uterus has not become ruptured or septic infection already taken place.

The median line is the best site for the incision into the abdomen, the pregnant horns being withdrawn singly and laid on a sterilised cloth or mackintosh, which is placed on the abdomen, and which has a slit in it through which the organ is drawn. Where an endeavour is to be made to save the fœtuses these should be carefully cut down upon and extracted as speedily as possible after these ligatures are placed in position, as otherwise they will die from asphyxia. They are then handed over to assistants, who dry them in warm towels and commence artificial respiration and other efforts to commence life. The puppies (or kittens, as the case may be) are then wrapped in flannel and placed in a basket on a hot-water bottle until ready to go to a foster-mother.

Even when the discharge has become offensive, the operation is worth attempting, as is evidenced by the following case,[1] which is only one of a large number :—

1 "Veterinary Journal," January 1907 (Hobday). Mr George Elmes, F.R.C.V.S., has also recorded a case (*Idem*, June 1914), in which one cornu only was successfully removed, and the patient lived and reared a puppy immediately afterwards.

The patient, a bull bitch, a primipara, aged two, was due to whelp, and commenced to show signs of approaching labour one Monday evening. Between then and Thursday she was delivered, with assistance, of three puppies, but it was very evident that there were several more to come. On Thursday evening, between midnight and four o'clock, two more were taken away with instruments ; one still remained, and from the fœtor of the uterine discharge and the palpable emphysema, which could be felt through the abdominal wall, it was evident that no time was to be lost if the bitch's life was to be saved. Under chloroform, using a kitchen table as the operating table, and securing the animal with hobbles, laparotomy was performed with the usual strict attention to antiseptic details, and a puppy

Fig. 77.—Photograph showing the size of the rupture in the uterus.[1]

swollen to an enormous size, was found at the top of the left horn of the uterus.

Ligaturing above each ovary and close to the mouth of the uterus, this latter organ, together with its contents, was completely excised. The muscle wound was sutured with silk and the skin with silkworm gut, the whole being covered with iodoform-colloid. She was fed cautiously for the next ten days, and made an absolutely uninterrupted recovery. Her only cause for complaint during the three or four days subsequent to the operation seemed to be that she could not find any puppies to nurse, the latter being all dead. The case is of particular interest because of the perceptible putrefaction which had commenced before the operation was performed, and the entire absence of all complications.

Even if the uterus has become ruptured and the fœtuses have escaped into the abdominal cavity it is worth while, as the

[1] Mr Peddie's case. *See* p. 149.

under-mentioned case (reported by Mr J. Peddie, F.R.C.V.S.) shows, to attempt surgical interference.

The patient was a bull bitch which had been "lined" by a retriever, and had gone her full time in pregnancy. She had commenced whelping on the 28th May, and Mr Peddie was called in on the 30th, two pups having been removed, together with a portion of a third.

On palpating the abdomen one large pup was felt in the uterine horn, but nothing could be touched *per vaginam*. Under anæsthesia an ovaro-hysterectomy was performed, and the patient made an excellent recovery.

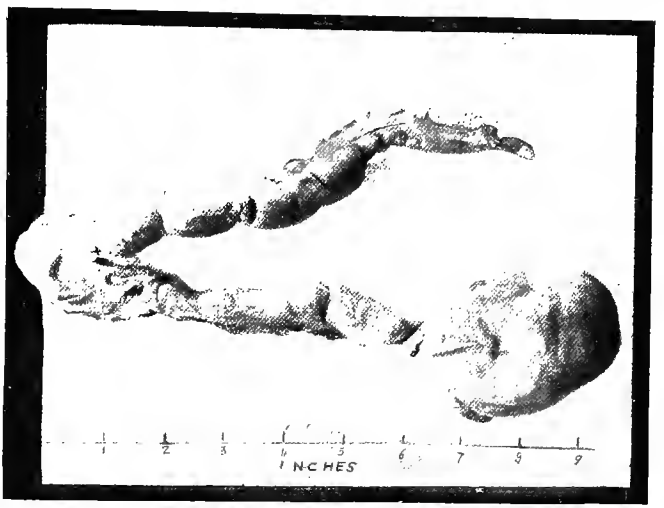


Fig. 78.—A case of pyelo-metritis from a bull bitch.
The right ovary was normal, and weighed 8 grains, and the left one was much enlarged, weighing $2\frac{3}{4}$ ozs.

OVARO-HYSTERECTOMY FOR PYELO-METRITIS.

The presence of pus in the uterus of the bitch and cat is not uncommon, and although medicinal measures may be temporarily attended with success, there is no doubt that this is one of the diseases which eventually must be allotted to the care and skill of the surgeon. It is usually met with in bitches or cats which have had one or more litters and not been allowed to be bred from again, although this rule is by no means constant, and one may meet with it in the maiden bitch. The first

symptoms shown are that the animal is a little dull and out of sorts at times, and that she is more easily tired at exercise; also that (it may be noticed for the first time at the œstral period) there is a drab-coloured discharge on the lips of the vulva, and that this leaves an offensive patch on the carpet or rug whenever she lies down. It is usually at this stage that professional aid is sought, and in some cases a course of tonic medicine, accompanied by careful cleansing of the vagina with antiseptics, will give temporary relief. In regard to the latter, an effort should be made by continuous syringing with warm boric acid solution to open the mouth of the uterus, and occasionally this can be accomplished to a sufficient extent to introduce a fair-sized catheter, and even to wash out some portion of the interior, but it seems an impossibility in the bitch and cat, on account of the shape and position of the two cornua to ever be quite certain which horn the catheter has entered, and even if it is made to pass into one or the other, to enable it to reach the extremity and cleanse the diseased mucous membrane.

A favourable result, too, sometimes follows the use of pituitrin or of the extract of hydrastis canadensis and the use of some antiseptic as a lotion for vaginal douching.

The following is quite a typical instance selected out of a large number of successful cases in which this operation was performed for this condition [1]:—

The patient, a bull bitch seven years old, had had one litter of puppies when two years of age, but had not been allowed to be bred from since. She had appeared in good health until about three months before being brought for examination, and after her usual period of œstrum the owner observed that she had a quantity of dirty, drab-coloured discharge from the vagina, this, although not smelling offensively, leaving objectionable stains on the rugs, carpets and chairs, or wherever the animal chose to lie down. Medicinal measures were tried without perceptible improvement for about three weeks, and at the end of this time the owner consented to ovaro-hysterectomy. This was done under chloroform and with strict attention to antiseptic details, ligatures of boiled silk being placed above each ovary and around the body of the uterus near the os, the whole of the organ

[1] "Veterinary Journal," 1908, page 401 (Hobday and Belcher).

between these being excised and removed. The abdominal muscles were sutured with silk and the skin with silkworm gut, the former being rather a coarse variety and giving a little trouble for about a fortnight, when the skin wound (which had healed almost throughout its entire length) had to be opened up again and the internal silk sutures removed. The patient after this made an uneventful recovery.

OVARIOTOMY AND OVARO-HYSTERECTOMY OF THE CAT.

The remarks on these operations of ovariotomy of the bitch apply equally to the cat, with one or two exceptions.

As an anæsthetic morphia is inadmissible, for its effect on the cat is that of a deliriant and not a narcotic. Chloroform or A.C.E. mixture should be used. The site of operation, too, except when pregnant or purulent, is better to be selected in the left flank rather than the median line, as the crouching position occupied almost continuously by a cat kept in a cage is apt to cause adhesion of the omentum (or intestine) to the wound, and the wound itself is apt to become contaminated, whereas with the wound high up in the flank this is scarcely likely to occur. If shaved and dressed with iodine as instructed in the preceding chapter it is rare for the wound to necessitate further treatment other than the removal of the sutures on the sixth or eighth day.

OVARIOTOMY OF THE MONKEY.

A female monkey in œstrum is apt to become very objectionable, and for this reason the veterinary practitioner is consulted. The ovaries are readily reached through a median incision, and either chloroform or A.C.E. mixture carefully given by means of an inhaler acts well as an anæsthetic. The precautions to take and principles of operating are practically the same as in the bitch, the incision being made in the median line just over the pelvis, but the uterus has a rounded body instead of two long cornua.

It is not the usual practice to take away the uterus itself, removal of the ovaries being the operation generally practised.

OVARIOTOMY OF THE SHEEP AND GOAT.

Sheep and goats are not spayed to any appreciable extent in this country, and it is not necessary to do more than just to refer to them.

The operation is performed on the left side, the incision being made through the flank.

Its object in the goat is to increase the milk-producing power, and in the sheep the tendency to increase in fat is well marked.

Ovaro-hysterectomy and **Cæsarean section** have each been performed with success in these animals,[1] the method of procedure being much the same as described for the adult sow in the next paragraph.

OVARIOTOMY AND OVARO-HYSTERECTOMY OF THE PIG.

Many thousands of female pigs are operated upon every year, and they are usually done for a few pence each by the country gelder, who is often so expert that the whole operation from start to finish only takes thirty seconds.[2]

No antiseptic preparations are made, and a death is a rarity, the only precautions taken being that the pigs shall be starved for twenty-four hours previously, also that they shall not be overfed, and shall be kept in a tolerably clean place for a couple or three days afterwards, although this latter precaution is often ignored.

The operation is usually performed when the "gilt" is from six weeks to three months old, the method being as follows:—

The operator takes hold of the animal by the left hind leg, and places his right foot on the neck, slightly raising the hind-quarters off the ground. Then taking the knife in his right hand (many country gelders carry it in their teeth until ready

[1] "Veterinary Journal," 1908, page 564 (A. Tait, M.R.C.V.S.); "American Veterinary Review," September 1910, translated from "Archiva Veterinara" (Podoska).

[2] The author has on several occasions timed this.

for use) he stoops over his patient, and deftly makes an incision in the left flank. Returning the knife to his mouth or his pocket he inserts his middle or forefinger into the abdomen and extracts the uterine horns, which are then excised. A cross suture (usually of string or thread) is inserted to draw the lips of the wound together, and the victim, who has been squealing vociferously all the time, is allowed to get on its legs and escape.

No after-treatment is employed, the sutures being rubbed out by the pig or falling out in the course of a week or ten days by themselves.

The object of spaying the young "gilts" is to prevent them from coming into œstrum and to cause them to fatten up more quickly.

In **full-grown sows** the operation is sometimes done to cause them to fatten and to improve the quality of the bacon, it being a common impression that if a sow is killed during her period of œstrum the bacon has a peculiar flavour.

Here, again, it is not always the practice to use an anæsthetic, although such should be done. A noose is placed over the animal's upper jaw and passed through the bars of a gate or round a post, whilst another noose is passed around the hind legs and drawn backwards, being fixed to another post or held by assistants. The squealing beast is then thrown on the ground on its right side and held there, whilst the left flank is opened and the ovaries withdrawn and removed, either by an écraseur or the clam and hot iron. The wound is stitched up, and a death is quite a rare occurrence.

For ovaro-hysterectomy in dystokia the patient is cast, secured and chloroformed, and after the skin has been painted with iodine or well scrubbed with ether soap and disinfectants in the usual manner, a long incision is made in the left flank. An assistant with a sterilised towel then presses back the intestines into the abdomen whilst the operator removes the horns and uterus intact. Ligatures are put on above each ovary and around the body of the uterus, and the whole excised. The little pigs, if alive, are quickly removed by

assistants and resuscitated by artificial respiration, the uterine stump is disinfected and returned, the muscles and skin are sutured separately, and the wound treated either with iodine each day or else by other antiseptic dressings applied by the aid of cotton wool and bandages.

Cæsarean section has also been frequently reported successfully performed in the pig, and the animals have been bred from afterwards, but to the practitioner who is only called upon

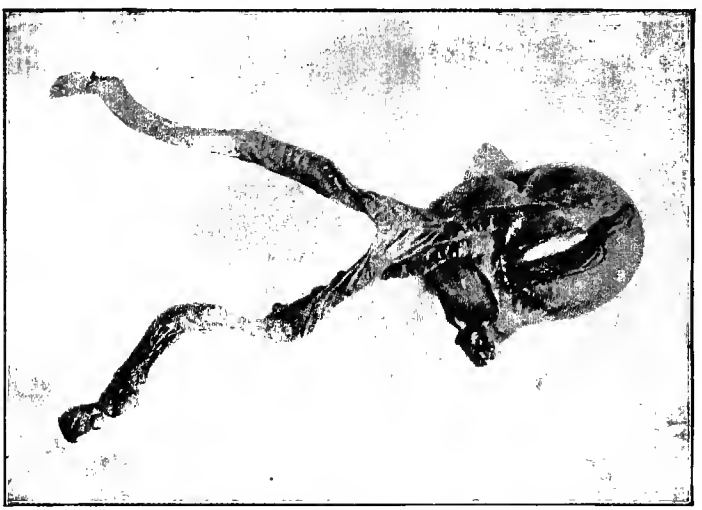


Fig. 79.—Myoma of the uterus in a retriever bitch [1]

to operate in this way occasionally, especially where the patient lives afterwards under such unpleasantly non-antiseptic conditions (if one may coin the word), as a pig, Porro's operation (the ovaro-hysterectomy) offers the better prospect of a successful sequel.[2]

TUMOURS.

Tumours of the uterus and ovaries are frequently met with in the smaller animals, and sometimes attain a great size.

[1] "Journal of Comparative Pathology and Therapeutics," Vol. X., page 73 (Williams and Hobday).

[2] "Veterinary Journal" (Ashley Young, M.R.C.V.S.), May 1914.

Penberthy has recorded a fibroma of the uterus weighing 19½ lbs. in a collie.[1] If confined to the generative organs they can be treated surgically by excision of the whole of these organs, but if of a malignant nature they may be inoperable.

Fig. 80.—Inoperable sarcoma of the pelvis and ovaries of a cat.[2]

In the case illustrated in fig. 79 the bitch was thought by the owner to be pregnant, and the tumour was discovered on exploratory examination.

1 "Journal of Comparative Pathology and Therapeutics,' September 1902.
2 "Veterinary Journal," Vol. LX., page 317 (Stroud).

CHAPTER X.

ABNORMALITIES OF THE SEXUAL GLANDS OF MAN AND HORSES.[1]

THERE are many facts in this book which have an interest for the surgeon. Few things in the operating theatre arrest the attention of the medical student more forcibly than seeing, for the first time, a dermoid of the ovary or of the testicle. The mode of origin of these extraordinary tumours has never been clearly explained, but our knowledge in regard to their occurrence in men and women, horses and mares has been advanced by the enterprises of surgeons and veterinarians. Formerly our knowledge of dermoids of the genital glands was obtained from observations in the *post-mortem* room, and the descriptions were brief and insufficient. The establishment of ovariotomy proved the frequency and importance of ovarian dermoids; some of the largest tumours found in women are dermoids. Careful examination of early examples removed during life have shown that they arise in the oöphoron or egg-bearing segment of the ovary. Gradually it was recognised that the essential part of an ovarian dermoid is the small organised body known as the embryonal rudiment. The grease, hair, epidermic cells and teeth which fill the cyst are waste products shed by the skin covering the embryonal rudiment. This curious body of varying complexity is now regarded as an imperfectly developed ovum, thus harking back to the opinion held by our predecessors that the ovarian dermoid is due to parthenogenesis. The remarkable experiments of Bataillon on the eggs of the

[1] For this chapter I am indebted to Sir John Bland-Sutton, F.R.C.S.

grass frog help to support this view. Bataillon found that by puncturing virgin eggs with very minute metal stylets carefully sterilised segmentation could be initiated. He succeeded, after puncturing 10,000 eggs, in producing three tadpoles. Eggs punctured by his stylets always segmented, but the development became arrested just short of the tadpole stage.

It is reasonable to believe that the **ovarian dermoid,** or embryoma, is an ovum that has been started into activity by some pathological cause, but not by a spermatozoon. Ovarian dermoids in mares are rare. I have only had an opportunity of examining one specimen. The hair in it was like that on the mane or tail. In women the hair in ovarian dermoids is like that on the head or on the pubes, but it rarely agrees in colour with that of its host.

There is a rare but extremely malignant form of ovarian embryoma, distinguished as **malignant teratoma** of the ovary. Such a tumour is solid, and consists of a conglomerate of fœtal tissues, skin with developing hair, sweat and sebaceous glands; developing teeth, brain matter, neuro-epithelium and cells, resembling choroidal pigmented tissue. These tumours arise mainly in girls and young women and give rise to secondary deposits in the peritoneum. They quickly destroy life. If removed they recur rapidly. Examples of malignant teratomas have not been recorded in mares. Cystic tumours of the ovary are common, and, as in women, benign.

TESTICULAR DERMOIDS.

Dermoids of the testicle are rare in man, especially if this term be restricted to tumours containing hair or teeth. It was formerly customary in text-books of surgery to state that dermoids of the testicle are common. British surgical and pathological literature of the last thirty years contains reports of six cases of testicular dermoids, and of these two came from China and one from India. There is a tendency to widen the definition of the term dermoid or embryoma of the testicle so

as to include some growths of the testis commonly called "general cystic disease," and this is probably correct. Mr Hobday has afforded me opportunities of examining several excellent and fresh specimens of testicular dermoids removed from horses. This shows that such tumours are fairly frequent in horses, and it is remarkable that all occurred in undescended testicles.

Testicular dermoids in man and horses are always unilateral; ovarian dermoids are often bilateral. Like the typical ovarian dermoid, such a tumour in the testis of a horse consists of a solid portion, the embryonal rudiment lodged in a cyst packed with grease, epithelium and shed hair. The hair and the teeth are equine in character. The relation of the dermoid to the testicle is peculiar. It does not grow in the secreting tissue of the testis, but arises in the body known as the paradidymis, between the true testis and the epididymis (*see* figs. 46 and 48). The paradidymis is composed of vestiges of the gonad, the embryonic organ or *anlage*, from which ovary and testis are derived.

I have long suspected that the source of testicular dermoid is unsuppressed ovarian tissue in the paradidymis. This opinion is supported by the observations of Pick, and others, that the sexual glands of human pseudo-hermaphrodites are liable to become the seat of embryomas.

Testicular dermoids of horses are interesting in another aspect. The majority arise in undescended or imperfectly descended testes; a dermoid in an undescended testis in man is extremely rare. I only know one recorded instance. The abdominal testis in man is liable to tumours, but they are invariably sarcomatous.

There is a remarkable difference in the undescended testes of horses and men. In this book the author furnishes evidence that in horses, testes retained in the abdomen or in the inguinal canal contain spermatozoa.[1] In man this is rarely the case; in him retention of the testis is often associated with inguinal hernia. It is a matter of safety and increases the

[1] *See* page 40.

chance of success if an imperfectly descended testicle is removed in the course of an operation for the cure of an inguinal hernia. There should be no hesitation in removing such an organ. After careful observations extending over many years I only once found spermatozoa in an undescended testis. It is commonly believed that the imperfection of an undescended testicle is due to its failure to reach the scrotum. This I believe to be an error. *An undescended testis fails to reach the scrotum because of its imperfection.*

THE EFFECTS OF CASTRATION AND SPAYING.

It is the experience of stockyards that the removal of the sexual glands in young animals is followed by an increased formation of fat and bone. This corresponds with the observations that adult eunuchs are usually gross and fat. Physiologists and anatomists have been puzzled by the discovery that the hypophysis (pituitary body) influences the growth of the body and the development of the sexual characters in a remarkable manner. Inefficient function of the hypophysis in men and women leads to excessive deposition of fat, loss of sexual power, and the genital organs revert to an infantile type. The term "pituitary eunuchism" has been suggested by Shattock for sexual inability in men due to this cause. When the hypophysis enlarges in adolescents the bones grow excessively and they become giants. If the hypophyseal changes occur after the obliteration of the epiphyses the characteristic changes of acromegaly (big ends or points) occur. It is remarkable that abnormal development of the hypophysis influences men in the same way as complete castration. It is worth attention on the part of veterinarians to determine if there be any definite changes in the hypophysis of the horse, mare, ram, ewe and sow associated with gelding and spaying.

The effects of removing the ovary and testes from ostriches is a matter of importance to naturalists and physiologists interested in the abnormal manifestations of the sexual characters, primary and secondary. It is well known to game-

keepers that hens which have ceased to lay eggs sometimes assume the plumage more or less completely of the cock. Such cock-feathered hens have an atrophied ovary. In all I have examined this condition of the ovary has always existed, but some observers are not satisfied with this explanation. The experience of South African farmers supports it, for the feathers of ostriches which have been caponised are finer, cleaner, and heavier than those ostriches which retain the ovary or the testes as the case may be.

In view of the discovery that the hypophysis and the adrenals (suprarenal capsules) influence the sexual functions and the secondary sexual characters, veterinary surgery, which is making such progressive strides, could add to this knowledge by investigating the gross and microscopic features of the hypophysis and the adrenals in caponised ostriches.

No comparison can be made of the effects produced by the removal of the ovaries in women with those observed in mares. Surgeons have fortunately never contemplated the removal of these organs to control vicious habits, erotomania, bad or incompatible tempers. The only approach to such measures has been bilateral oöphorectomy in epileptics, but this is rarely practised and has never received professional endorsement.

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